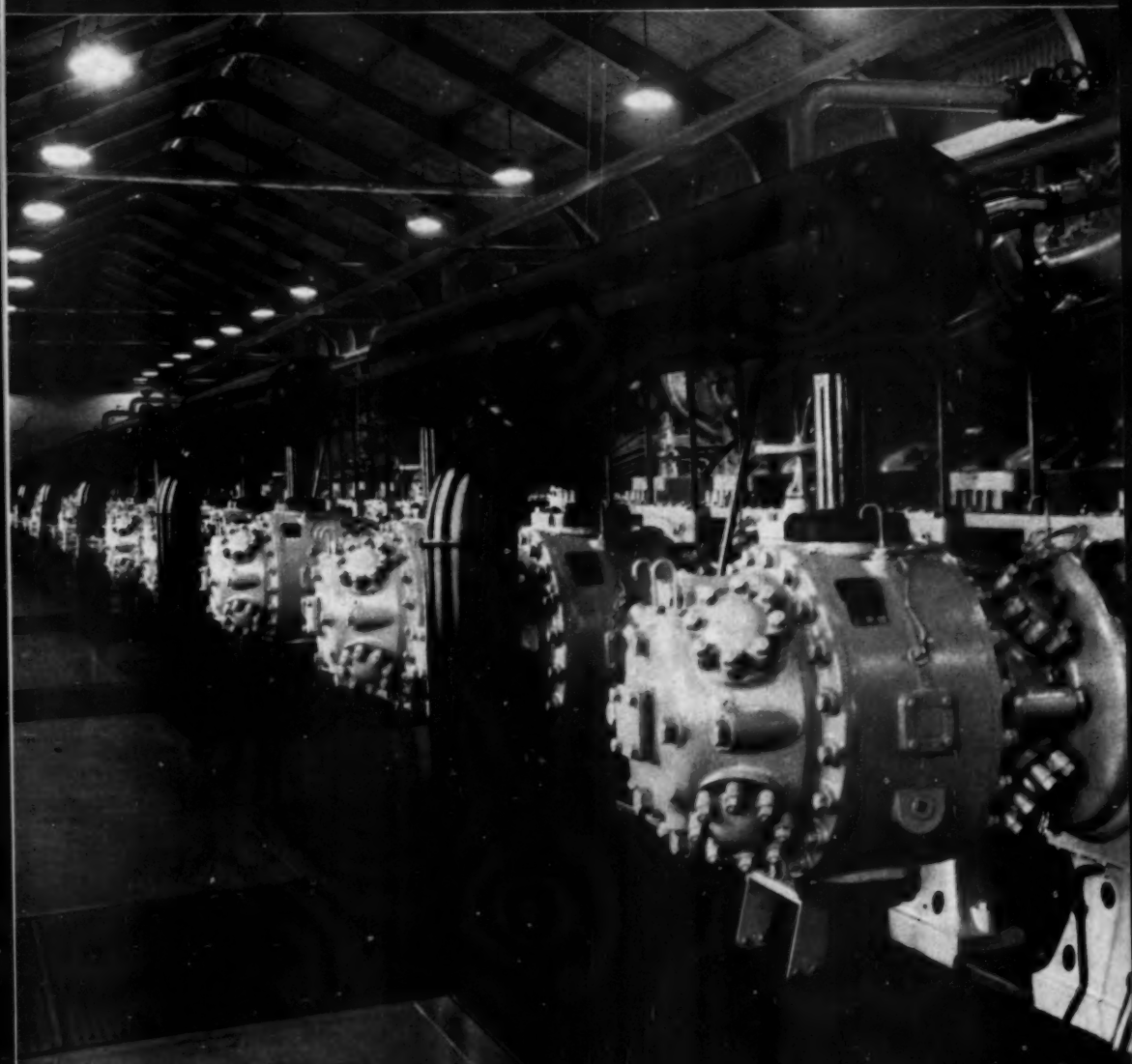
INDUSTRY AND POWER



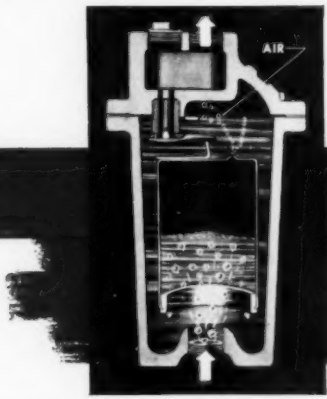
PLEASE ROUTE TO

Superintendent	Plant Engineer	Chief Engineer	Power Engineer	Master Mechanic	Electrical Engineer	Maintenance Supt.	Purchasing Dept.

TABLE OF CONTENTS PAGE . . . 5

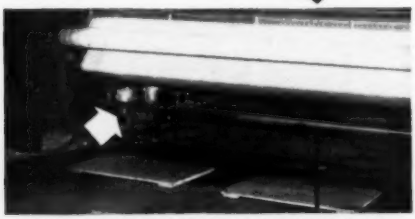
Armstrong traps vent air to give you hotter machines

HIGHER TEMPERATURES MEAN MORE OUTPUT



PSIG	Temp. of Steam with No Air Present	Temperature of Steam Mixed with Various Amounts of Air. (Per Cent Air by Volume)		
		10%	20%	30%
10.3	240.1	234.3	228.0	220.9
25.3	267.3	261.0	254.1	246.4
50.3	298.0	291.0	283.5	275.1
75.3	320.3	312.9	304.8	295.9
100.3	338.1	330.3	321.8	312.4

THIS TABLE TELLS THE STORY. You can't get the maximum temperature you need unless you get the air out.



PYROMETER TESTS SHOWS 30° TEMPERATURE INCREASE on flatwork ironer rolls at *Peter Bent Brigham Hospital, Boston,* after installation of Armstrong traps which vent air along with condensate.

EVERY time an Armstrong steam trap opens there is a momentary pressure drop which "pumps" air down to the trap from the unit being drained. The air passes through the bucket vent and accumulates at the top of the trap to be discharged along with condensate each time the valve opens.

This one basic benefit of the Armstrong trap is saving industry thousands upon thousands of dollars through faster heat-up and higher, more uniform temperatures with resultant greater output and time and labor savings.

You can have this benefit. The cost of Armstrong traps is small in relation to the efficiencies they effect. Call your nearby Armstrong Representative today.

ARMSTRONG MACHINE WORKS
820 Maple Street • Three Rivers, Michigan

SEE OUR CATALOG IN SWEET'S or CEC

HOW TO SELECT the right trap for each application, installation pointers, prices, capacities, other facts and figures are contained in the 36-page **STEAM TRAP BOOK.** Send for your copy.

ARMSTRONG STEAM TRAPS

DOUBLE HEATING DUTY

from TRANE unit heaters

Brand new idea in heat *diffusers*

Block drafts from a window and send heat down a production line — with *one* unit . . . Wrap a doorway in comfort and heat a row of work benches — with *one* unit . . . Warm a chilly wall and send comfort into a tool room — with *one* unit . . .

A Trane Unit Heater with finger-tip adjustable Louver Cone or Louver Fin Diffuser aims heat more accurately, diffuses it more evenly, throws it farther, or sends it in several directions at once if you like.

The completely adjustable diffuser blades split, diffuse and control the air flow, making Trane Unit Heaters more efficient, more versatile than ever before.

And the diffusers do even more than shape the heat pattern to fit your job: The Louver Cone Diffuser is designed to straighten out the natural corkscrew motion of the air flowing from the vertical-discharge unit, sending heat as much as 60% farther. Thus, you can mount Trane Projection Unit Heaters higher — easily clearing craneways and other obstacles.

With blades shut, the Louver Cone diffuses air gently, evenly in all directions, so even with low mountings, workers close to the heat source won't feel a concentrated blast.

Attached to the horizontal-discharge Model H Unit Heater, the Louver Fin Diffuser works the same heat-handling miracles.

And when heating targets change, you don't have to move the unit, add more piping, or more units — you don't even need tools. Just a fingerflip of diffuser blades moves the heat right where you want it.

For full information on Trane Unit Heaters and Diffusers, see your local Trane representative or write The Trane Company, La Crosse, Wisconsin.

A flip of Louver Cone Diffuser blades shifts Projection Unit's heat patterns.

Projection Heaters sending comfort, efficiency down from the ceiling.

Louver Fin Diffuser delivers Model H Unit's heat where you need it.

(Left) Louver Cone straightens air flow, throws heat farther, gets it to floor. (Center) One unit and diffuser does two jobs, sending heat straight down, diffusing it outward. (Right) Louver Fin sends heat right and left; perfect diffusion, perfect comfort even for workers close to unit.

TRANE

The Trane Company, La Crosse, Wisconsin • Eastern Mfg. Division, Scranton, Pa. • Trane Company of Canada, Ltd., Toronto . . . Unit Heaters, Convectors, Heating and Cooling Coils, Fans, Compressors, Air Conditioners, Unit Ventilators, Special Heat Exchange Equipment, Steam and Hot Water Specialties.

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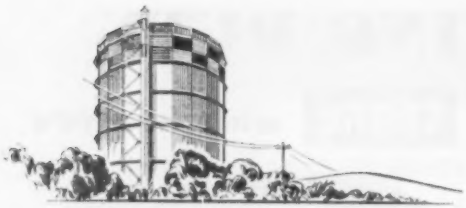


The Harrisburg Gas Co.

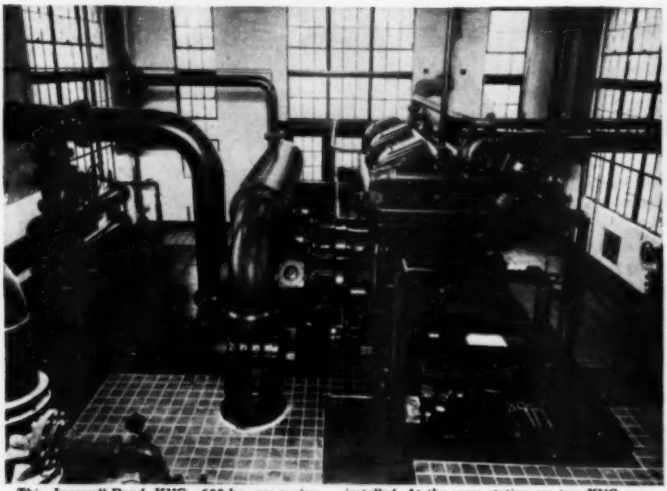
HAS GONE A LONG WAY IN THE PAST 100 YEARS

Erected in 1850 at Harrisburg, Pa., the original plant of The Harrisburg Gas Co. had a maximum output of 25,000 cubic feet per day. Now the company's combined facilities, including a unit under construction, are rated at more than *35,000,000 cubic feet per day!* What's more, growth has continually kept pace with the latest technological advances in the industry. At Steelton, for example, a new catalytic cracking plant has recently been completed—one of the first of its type in the United States.

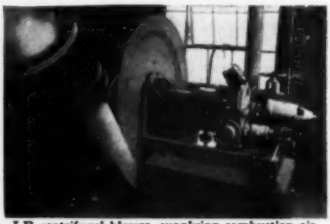
During the past century of progress, The Harrisburg Gas Co. has always placed the emphasis on *continuity of service*, which can be secured only by *quality of construction.* That's one of the reasons why it has repeatedly specified Ingersoll-Rand Compressors and Blowers for all major installations.

The *proved dependability*, operating economy and low-cost maintenance of I-R equipment have become almost a tradition in the gas industry. It took years of experience to build up this reputation—experience in the design, manufacture and application of air and gas handling equipment to meet the rapidly changing needs of the industry. All of this experience is at your disposal—no farther away than your nearest I-R representative.

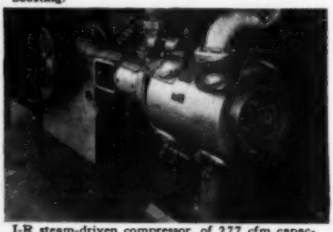
. . . with the help of dependable I-R equipment like this



This Ingersoll-Rand KVG, 600-hp gas-engine-driven compressor at the Steelton station can pump 335,000 cubic feet of gas hourly, at 34 psi pressure. A duplicate KVG is currently being installed. At the same station are two XVG gas-engine-driven compressors, each having a capacity of 120,000 cfh.



I-R centrifugal blower, supplying combustion air for oil and gas burners in catalytic cracking furnace. Another I-R blower is used for pressure boosting.



I-R steam-driven compressor, of 277 cfm capacity, supplying process air to the cracking furnace at 20 psi.

Two XPV steam-driven 150,000 cfh compressors handling high-pressure distribution for the Harrisburg station.

Two more I-R steam-driven compressors on high-pressure distribution at Harrisburg. The unit at the right has been in service since 1914.

I-R Type 30 compressor supplying 60-psi air for operating the cracking-plant control instruments.

Ingersoll-Rand

11 BROADWAY, NEW YORK 4, N. Y. 570-1

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INDUSTRY AND POWER

The Magazine for the Plant Engineering Group

VOLUME 60 **MARCH, 1951** NUMBER 3

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Established May, 1920

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INDUSTRY and POWER, including INDUSTRIAL POWER, is published monthly at St. Joseph, Michigan. Accepted under the act of June 5, 1934, authorized August 31, 1942.

Cover Illustration

Eight Cooper-Bessemer Type GMV two-cycle, ten-cylinder gas-engine compressor units, developing 8300 hp, are installed at the Hope, Ark., station of the Texas Eastern Transmission Corp. This plant is one of the compressor stations on pipe lines feeding natural gas to the New York area from Texas. (See page 86)

FEATURE ARTICLES

Mead's Kingsport Mill Modernized 69
A. S. Wells, The Mead Corporation

The Proper Water Tower Means Water Conservation 73
Howard E. Degler, The Marley Company, Inc.

Know Your Fuses 76
J. C. Lebens, Bussmann Manufacturing Company

Efficiency Plus With Proper Instrumentation 78
Eugene B. Sheker, Brown Instruments Div.

Inland Steel Has Super Coal Preparation Station 82

Smog Is Literally In "The Bag" As It Meets With These Collectors 84

Gas-Engine Compressors on Big Inch Lines—The Front Cover 86

Centrifugal Pumps—Types and Sub-Divisions 87
Igor J. Karassik and Roy Carter, Worthington Pump & Mach. Corp.

Keeps Coal Bunkers' Noses Clean 89
Leonard W. Williams, Manager Technical Services, Lukens Steel Company

Interpreting an Alkalinity Analysis 90
S. L. Terry, Southwestern Public Service Company

Alcoa's Answer to Stream Pollution 92
William B. McMorris, Aluminum Company of America

Phillipsburg Kansas Has First Large Dual Fuel Installation 94
Edward P. Hennek, President, Western Light & Telephone Company

Mechanical Differentials Can Solve Transmission Problems 96
W. F. Priest and G. R. Toomey, Simplex Wire & Cable Co.

Belt Reduces Slippage and Power Loss 98

Develops Refractory for Ultra-High Heat—Good at 4350 F 100

DEPARTMENTS

Acorns of Science 6
New Equipment and Developments 11
New Bulletins and Catalogs 20
What to Do Until the Doctor Comes 81
Materials of Construction 102
How To, Shop Kinks and Hints 105
Plant Engineer's Handbook 107
"Spot" News of Industry 110
Readers' Guide to Advertised Products 117
News of Men and Companies 124
Meetings and Exhibitions 128
Reviews of Recent Books 129
Advertisers' Index 148

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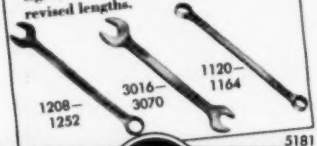
Redesigned PROTO open end, box and combination wrenches have narrower jaws and heads, stronger designs, smoother shanks, better finish, revised lengths.



PROTO TOOLS

LOS ANGELES

Acorns of Science

Developments not yet available, but of interest to the Plant Engineering Group as previews of future tools and methods

Scanning Corrosion

● Each and all of thousands of microscopically small electrochemical cells formed by corrosive fluids and the metal itself can be studied by a rotating sample method developed at Illinois Institute of Technology. A probe, .02 in. from the revolving sample, picks up a potential from each minute cell as it passes beneath. Amplified variations of the potentials studied on an oscilloscope screen yield data on corrosive fluids, cathodic protection, stresses and inhibitors.

Crystal X-ray Amplifiers

● Semi-conducting crystals "grown" at the General Electric X-ray Corp. have a million times the X-ray sensitivity of an ionization chamber and a thousand times that of a photo-electric cell. They mean cheaper, low-voltage tubes using better shielded beams can be used at much higher speeds for X-ray electric-eye applications for checking levels, density, thickness, voids and presence of inserts in opaque materials. Although now limited to reading intensity of single beams, or at best to integration of an area with a series of crystals, the usability of X-rays has been greatly increased and a new field of crystal electric research opened.

Molybdenum Disulphide

● This compound has been found effective as a lubricant to inhibit fretting corrosion which takes place when closely fitting metal surfaces have a slight relative motion and which frequently causes failures in machine parts subject to vibration.

Free-Piston Engine

● Actually a supercharged two-cycle diesel, the free-piston engine produces gas at 75 psi and 900-950 F to drive turbine supplying power output. A Department of Commerce report on the French development shows operating stability, despite lack of connecting rod and crankshaft linkages, with thermal efficiency of conventional diesels and advantages of gas turbine.

Hydraulic Turbine Drill

● With the turbine on the drill, hydraulic power is transmitted to the bottom of an oil well. Power is kept constant as the hole gets deeper. Faster, straighter and cleaner wells result, according to the American Petroleum Institute.

Purifying Hydrogen

● A patent just issued teaches that all ordinary impurities of hydrogen can be removed by passing it over uranium heated to 700-800 C.

Temperature Changes Color

● Paint of a new type changes color automatically with increasing temperatures. It is being used by Socony-Vacuum Oil Co., Inc., in studies of cooling processes for air-cooled internal combustion engines. Formulated to provide fifteen basic shades for original application, it helps determine proper locations of thermocouples for actual temperature measurements.

Electrostatic Camera

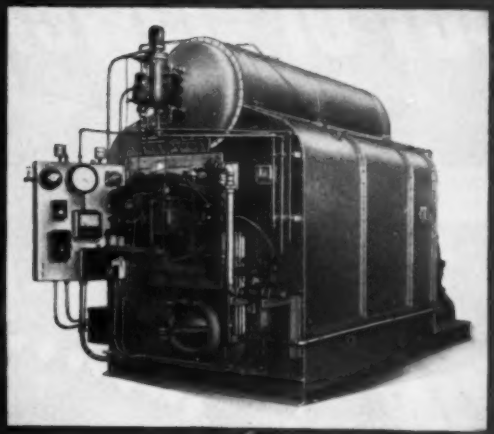
● Sensitized by an electrical charge, a selenium-coated metal plate records an invisible electrical image when exposed in the camera. Finely ground powder dusted on the plate is held by the charge, whose strength was varied by the light intensity in different parts of the image. The powder picture is then transferred to adhesive-coated paper or other material. The plates are unaffected by light unless sensitized, can be wiped off and reused and are about as fast as ordinary orthochromatic film. Camera development was sponsored by the Signal Corps.

Open-Hearth Jet Tapper

● Small, high - explosive, shaped charge, a principle used in recent military rockets, has been developed for tapping open-hearth steel furnaces by Arthur D. Little, Inc. It not only speeds and simplifies the tapping operation, but increases the safety of the operators.

Here's What You Get...

for your KEYSTONE STEAM GENERATOR *dollar*



Compact Design—The Keystone packs large steam capacity in small cubage, because of its unique furnace, contained within a low-head 2-drum water tube boiler.

Conservatively Rated—The Keystone offers unusually large heating surface per developed horsepower. Ratings are based on 5 square feet per developed horsepower—accepted practice in water tube boiler design.

Fast Steamer—The Keystone is highly responsive to changing load demands, for hot gases travel 3 lengths of the furnace, contacting 5 bare metal heat absorbing zones. Big boiler performance in small space.

Centralized Control—All specified instruments and controls, factory assembled, and mounted on a central instrument panel. All electrical connections to terminal blocks eliminate inter-connecting field wiring.

Automatic Burner—The Keystone is equipped with fully automatic burner for gas, oil or for both interchangeably.

Insulated Steel Casing accurately fitted to reduce radiation losses and air infiltration—removable panel type—all tubes accessible.

Combustion Control—interlocked electrical controls, steam pressure actuated for smooth adjustment of fuel, primary and secondary air supply to obtain most efficient high and low flame position.

Induced Draft equipment is of low speed, conoidal type with automatic damper control on panel.

Safety Controls include automatic cut-offs for high pressure, low water, flame failure, induced draft failure and fire switch.

Easy to install—easy to maintain—Keystone requires no special foundation or stack—just set in place and hook up service connections. Wind box is hinged for easy furnace inspection, hinged burner swings out for inspection—removable side panels give access to any tubes—manholes provide access to drums and tubes.

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FEWER PULLEY GROOVES — LONGER BELT LIFE

There's a whale of a saving in power transmission costs when you use the premium Dayton Cog-Belt! It delivers 40% more h.p. than an ordinary V-Belt. Here's why—

Cog-Belts are built to bend—like your finger—to take up compression strains as the belt goes round the pulleys. Results: Less strain, less heat, less stretch, less maintenance, longer life, less down-time.

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Save drive-space, plant space! Cogs permit much shorter center-to-center distances—up to 25% shorter. They save up to 47.2% in drive area.

To end your V-Belt troubles for the long "duration" ahead, give your Dayton Distributor the "high-sign" of better V-Belt power transmission: the arched finger that means Dayton Cog-Belts and important savings!

*T.M.

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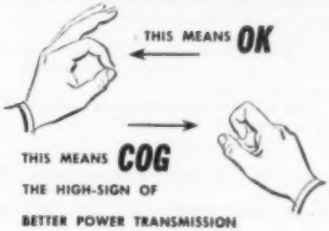
14 years ago a set of Dayton Cog-Belts went to work, running the tipple at a coal mine at Logan, W. Va. These same veteran Cogs are still on the job! The mine superintendent predicts that they are good for years to come. If you have a drive that's a real toughie, turn it over to a team of Dayton Cog-Belts, for a long, trouble-free life!



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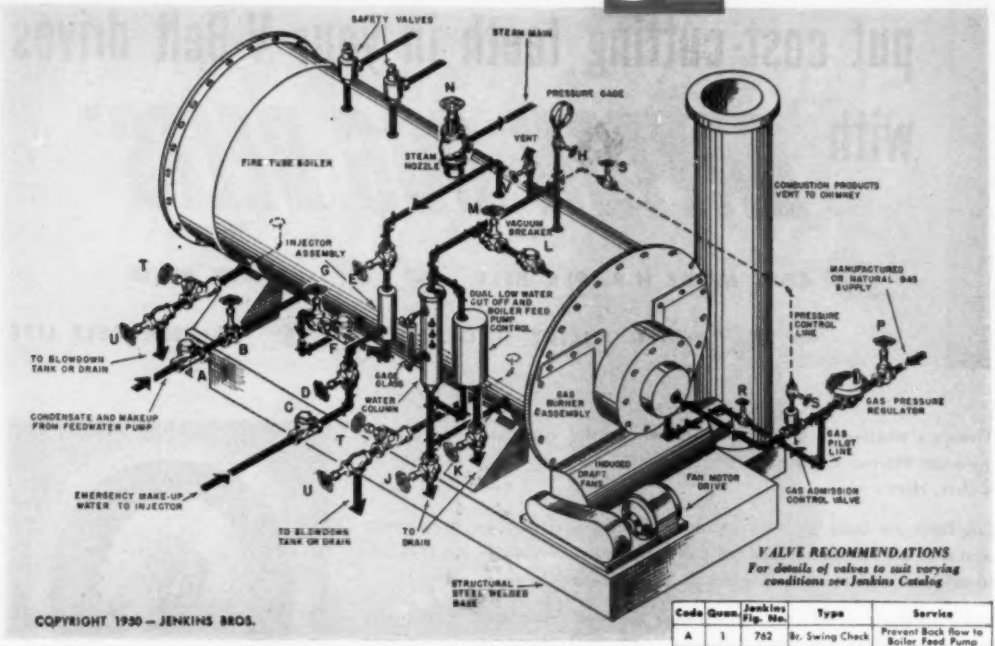
JENKINS PRACTICAL PIPING LAYOUTS 52



VALVE RECOMMENDATIONS
For details of valves to suit varying conditions see Jenkins Catalog

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Code	Quan.	Jenkins Fig. No.	Type	Service
A	1	762	Br. Swing Check	Prevent Back flow to Boiler Feed Pump
B	1	49	Br. Gate	Feedwater Shutoff
C	1	762	Br. Swing Check	Prevent Back flow to Emergency Make-up
D	1	950	Br. Globe	Emergency Make-up Manual Control
E	1	956	Br. Globe	Control Steam Flow to Injector
F	1	762	Br. Swing Check	Injector Mixture to Boiler
G	1	950	Br. Globe	Emergency Make-up Admission to Boiler
H	1	741-G	Br. Needle	Pressure Gage Control
J	1	956	Br. Globe	Water Column Blowdown
K	1	956	Br. Globe	Blowdown Control
L	1	756	Br. Lift Check	Vacuum Breaker Air Admission
M	1	950	Br. Globe	Vacuum Breaker Shutoff
N	1	925	I.B.B.M. Angle	Steam Nozzle discharge
P	1	370	Br. Gate	Gas Shutoff
R	1	741-G	Br. Needle	Gas Pilot Shutoff
S	2	741-G	Br. Needle	Pressure Control Line Shutoff
T	2	134	Br. Blowoff	Blowdown assembly
T	2	297	I.B.B.M. Blowoff	Blowdown assembly
U	2	952	Br. Angle	Blowdown assembly
U	2	615	I.B.B.M. Angle	Blowdown assembly
V	1	741-G	Br. Needle	Boiler Vent Valve

How to plan PACKAGE BOILER CONNECTIONS

Package Boiler Units for power generation, heating and industrial process work, are in increasing demand. Usual requirements vary from 20 to 500 boiler horsepower and for pressures up to 900 p.s.i. Shown here is a gas fired, 100 p.s.i., fire tube type, with all piping connections conforming to A.S.M.E. Boiler Code.

Two means of boiler feed are provided, the normal feed from condensate return and the emergency feed by means of a manually operated steam injector. A dual low water cut-off and boiler feed control is provided with float and electrode type cut-offs and boiler feed control for maintaining constant water level incorporated in a single unit.

The failure of feedwater from the normal source would cause this dial unit to cut off the fuel supply and sound an audible alarm. If boiler operation is required immediately, cold water make up can be introduced through the manually operated steam injector.

Consultation with accredited piping engineers and contractors is recommended when planning major piping installations.

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new equipment and developments

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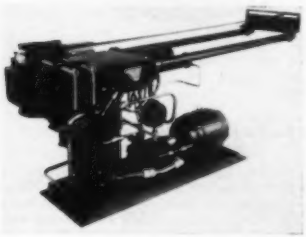
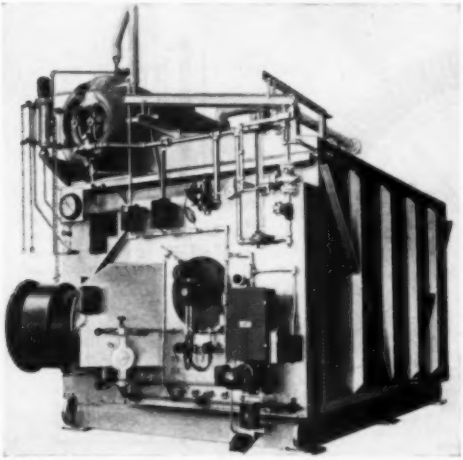
1—HYDRAULIC BENDER IS COMPACT

A production or custom bending machine, Model No. 800, is now available from the Wallace Supplies Mfg. Co. It is a small compact bending machine only 21 in. wide x 34 in. high x 78 in. long but has



the capacity to bend 1-¼ in. OD x 16 B.W.G. steel tubing. The unit is powered by a standard 2-hp, 220/440-v 3-phase, 60 cycle motor furnished with the machine. Operation is by a single lever, which when pushed down causes the bending arm to swing around to the degree of bend selected. The bending die, which is a combination four different sizes, is held on by spring clips, for easy changing. The bender can be changed from a right hand to a left hand operation by changing the pressure and clamping arms over and inserting the bolts into holes ready for that purpose.

2—PACKAGED BOILERS HAVE 3,000 TO 30,000 LB RANGE



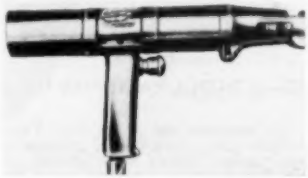
Foster Wheeler Corp. has announced that packaged steam generators are available in capacities ranging from 3,000 to 30,000 lb of steam per hr. These units provide heating surfaces of from 606 to 3,675 sq ft. They can be supplied in any of the following pressure groups—100 to 300, 450 or 850 psi. All units have fully automatic controls and are adaptable to any steam requirement. They are also designed for the installation of superheaters. Another feature is the ease with which it can be shipped by any type of common carrier. These units are ready for immediate operation after service connections have been made.

3—TURBINE-GENERATORS FOR 500-7,500-KW RANGE

WA-series steam turbine-generator units, a modern line presently developed in 500 to 7,500-kw ratings, has been announced by Allis-Chalmers Mfg. Co. Multi-stage, all-impulse steam turbine-generators contain nearly 50 years of experience on units from 250 to 150,000-kw. Maximum steam economies can be realized with this turbine power. The units are high speed, compact and streamlined. They can operate with economical regenerative feedwater heating cycles and can also be tied-in thermodynamically to provide a steam-power balance where low pressure process steam is utilized. Governor and regulating characteristics provide for paralleling with existing units and tie-lines.

4—AIR-OPERATED SAW HAS MANY IMPROVEMENTS

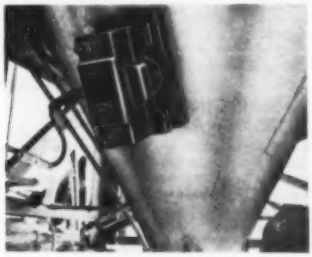
Air-Speed Tool Company's reciprocating air-operated saw and file tool contains many refinements over the 1950 and 1951 models. Among the changes are: simplified gun



valving, strengthened and tapered internal springs and increased weight and gage of the plunger washers to insure trouble-free operation. Important design improvements have been made on the exhaust ports, and extra precautions have been taken to prevent the entrance of abrasive materials. The tool is fully portable. It may be used to work on steel, stainless steel, dural alloys, iron, aluminum, brass, copper, nickel; plastics, plexiglass, fibreglass, wood and porcelain. Only a 1/32 in. wide and ½ in. long starting hole is required to begin cutting operations. Working stroke of the tool is adjustable from ¼ to 1-1/4 in.

5—ELECTRIC VIBRATOR SEMI-NOISELESS

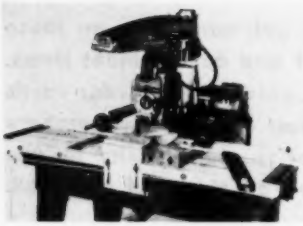
Syntron Co. has announced an addition to its line of bin, hopper and chute vibrators. These units perform the same function as the standard models, with a sharp reduction in the operating noise, making them especially useful on interior bins, hoppers and chutes where personnel are working. The metallic striking parts have been eliminated and rubber bumpers substituted to deaden the noise. Available in four models,



with capacities ranging for use on small hoppers containing as little as 20 cu ft of material up to bunkers holding hundreds of tons. Operation can be either 110, 220 or 44-v a-c. Intensity of vibration can be regulated to suit the material being handled.

6—POWER UNIT HAS MANY APPLICATIONS

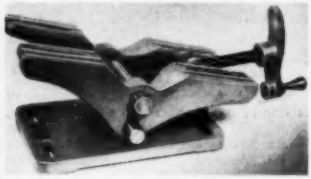
DeWalt, Inc. has introduced two models to its line of power feed machinery that incorporates ideas to meet the demands of today's market. They permit builders, lumber yards and others to produce hard-to-get finished materials such as finished flooring, window stripping and moulding. Model GE '400' is a standard GE radial arm machine that features a safety power feed unit—safety power feed and custom table top. Model GR '400' is a standard model GR with the same features. The custom table has a pressure arm, a spring hold-in and a spring tensioned hold-down. It permits an operator to run moulding, shape, rip, bevel



rip, tongue and groove, rabbet and plough. The safety power feed unit can be easily swung out of position when not required. The unit can be used for cross-cutting, mitering, cross-dadoing and sanding.

7—TILTING MOTOR BASE FOR FRACTIONAL MOTORS

The Lovejoy Flexible Coupling Co. is now producing a light weight, adjustable, tilting motor base for use with fractional motors up to one horsepower. It is adjust-



able in width and length to accommodate all sizes and types of fractional horsepower motors. It can be used with variable speed pulleys, and it acts as a belt tightener. Speed changes can be made while the machine is in operation. Correct belt tension and correct alignment is constantly maintained. Exact speed control is easily obtained by simply turning a handle screw adjustment.

8—SERRATING TOOL FOR GRAPHITE PIPE

National Carbon Div., Union Carbide and Carbon Corp. now has available an improved hand serrating tool for use with "Karbate" brand impervious graphite pipe. Since type FC flexible couplings are used in fitting impervious graphite pipe where strong, flexible joints are required, the effectiveness of the joint depends to a considerable extent upon the quality of the serrations on the pipe. The tool is simple in design and extremely easy to use, assuring a tight, workmanlike joint in the minimum of time. It provides an advantage over other types of piping since it facilitates quick assembly of "Karbate" pipe on the job site. Pipe sizes from 1 to 6 in. inclusive may be serrated.

For more information use one of the convenient reply cards on page 1xx. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you.

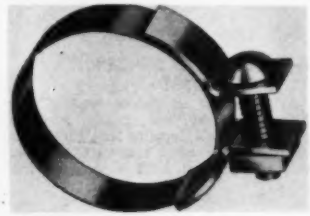
9—CROSS-ARM HANDLE CLOSES PRESSURE VALVES

A cross-arm handle incorporating the handwheel principle has been announced by Edward Valves, Inc. This device is a means for exerting greater effort to positively close a valve against high operating or test pressure. It delivers 2.8 times the closing force of regular handwheels. Ideally suited for 1-¼, 1-½ and 2 in. size Univalves of 1500 and 2500 psi and 2 in. size hydraulic valves. In operation, two lugs of the cross-arm

handle strike equal blows simultaneously against the opposite sides of the small adaptor, which is permanently attached to the valve stem. Wrenches or extension bars are not needed to deliver this extra force.

11—HOSE CLAMP MADE OF STAINLESS STEEL

A line of stainless steel hose clamps has been announced by the Specialty Products Co. Already in mass production, they are available in six sizes ranging from ½ to 2 in. The clamping band is made of 26 gage ¼ hard stainless steel, while the "ears" are made of 18 gage stainless. According to the manufacturer, there is no possibility of corrosion since the complete unit, including



the nut and bolt, is made of stainless steel. Six standard stainless clamps and also engineers clamps are made to special requirements.

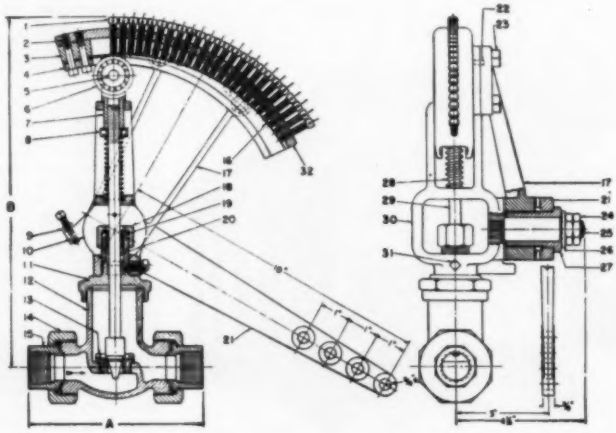
12—PANELBOARD HAS FUSIBLE FEATURES

Square D Co., has added a panelboard to its line of fusible lighting equipment. These devices provide plug fusible branches with heavy duty toggle switches for lighting and appliance branch circuit control. They are available from 4 to 40 circuits for use on either a-c or d-c applications and carry the approval and label of the Underwriters' Lab-

(Continued on page 16)

10—CONTROL VALVE HAS MULTITUDE OF SEATINGS

The adjustable cam of the Atlas Valve Company's No. 235 adjustable lift-opening lever operated control valve provides an easy method of fixing the valve lift at the required position for any point within the range of the valve movement. It is said to be an ideal valve to maintain a ratio, such as oil flow and air flow in an oil fired steam boiler. This valve is equipped with a flexible cam sheet, attached at one end to a cam arm. Curvature of the cam sheet is adjusted by screws, and the roller is attached to valve stem, which is forced upward against the cam sheet. Thus the lift of the valve stem and disc away from the valve seat follows the curve of the cam sheet on the line set by the adjusting screws. This fixes the ratio of valve lift-opening.



Whose...

"EXPERT ADVICE" SHOULD YOU FOLLOW?

With a host of water conditioning "specialists" ready to step in and "solve" your water problems, the job of picking the service best suited for your needs isn't easy. But when you make your selection, consider carefully these three vital factors for successful, economical plant operation:

- A service based on a sound engineering background
- A service with a proven record
- A service backed by ample engineering facilities

Let's discuss it!

W. H. & L. D. BETZ, Gillingham & Worth Streets, Philadelphia 24, Pa. In Canada: BETZ Laboratories Limited, Montreal 1.

BETZ

BOILER WATER CONDITIONING • COOLING WATER CONDITIONING • INDUSTRIAL WASTE TREATMENT

"WE WERE LOSING 5 KILN MOTORS PER MONTH UNTIL WE CHANGED TO FUSETRON dual-element FUSES."

Malvin E. Adams,
Electrician

OZARK HARDWOOD COMPANY

PHONE 252

JOE B. MILLS, MANAGER

CLARKSVILLE, ARKANSAS
April 20, 1950

Bussmann Manufacturing Co.

St. Louis, Missouri

Dear Sir:

I have found a great savings in your Fuzetrons.

Two and one-half years ago I started changing my Dry Kiln motors to Fuzetron protection. Up until I changed completely I was loosing an average of 5 motors per month which was very expensive. I was having to fuse my motors too heavy to pick up the load, then if something went wrong the fuse were too heavy and held the motor on the line, therefore burning it up.

My Kiln motors are 1½ h.p. 5 amp. I fuse them with 5 amp fuzetron. The fuzetron will hold this starting load and when it picks up I still have motor protection if anything goes wrong the fuzetron will blow in time to keep the motor from burning up. I fuse my main pannell with 6 - 600 amp. fuzetron. I used to blow fuses on this until I changed to fuzetron, therefore, taking care of the surging load.

I have approximately 800 h.p. I fuse almost all the plant on fuzetron. My trouble has been very light since changing to fuzetron for motor protection Fuzetron is tops with me.

Yours very truly,

Malvin E. Adams

Malvin E. Adams
Electrician

FUSETRON

TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION

BUSS

Fusetron DUAL ELEMENT Fuses

Give 10 Point Protection

- ★Protect against short circuits.
- Protect against needless blows caused by harmless overloads.
- Protect against needless blows caused by excessive heating — lesser resistance results in much cooler operation.
- Provide thermal protection — for panels and switches against damage from heating due to poor contact.
- Protect motors against burnout from overloading.
- Protect motors against burnout due to single phasing.
- Give DOUBLE burnout protection to large motors — without extra cost.
- Make protection of small motors simple and inexpensive.
- Protect against waste of space and money — permit use of proper size switches and panels.
- Protect coils, transformers and solenoids against burnout.

★ Fusetron Fuses have high interrupting capacity as shown by tests of the Electrical Testing Laboratories of New York City in December 1947.

What is the FUSETRON Dual-Element FUSE?

A fuse link combined with a thermal cut-out — the result, a fuse with tremendous time-lag and much less electrical resistance.

They have the same degree of Underwriters' Laboratories approval for both motor-running and circuit protection as the most expensive devices made.

Made to same dimensions as ordinary fuses, FUSETRON Fuses fit all standard fuse holders.

Obtainable in all sizes from 1/10 to 600 ampere, both 250 and 600 volt types. Also in plug types for 125 volt circuits.

Their cost is surprisingly low.

Don't risk losses in your plant!

One **lost** motor,
One **needless** shutdown,
One **destroyed** panel or switch,
One **burned out** solenoid —
May cost you more than replacing every ordinary fuse with a FUSETRON dual-element fuse.

Fusetron is a trade mark of Bussmann Mfg. Co., Division of McGraw Electric Co.

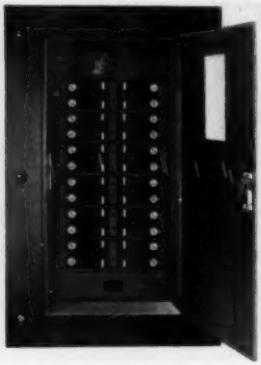
Bussmann Mfg. Co., University at Jefferson, St. Louis 7, Mo. (Division McGraw Electric Co.)

Please send me complete facts about FUSETRON Dual-Element FUSES.

Name_____
Title_____
Company_____
Address_____
City_____ State_____ 351

(Continued from page 12)

oratories, Inc. Construction features embody a 17 in. wide x 4-¼ in. deep box with 4



in. wide wiring gutters. Ample knockouts are provided in the ends and sides. Four branch circuits are contained in the high strength, one piece molded bakelite blocks.

13—VACUUM GAGE RESPONDS QUICKLY

Vacuum gage with a five-position switching attachment has been announced by the

Hastings Instrument Co. This direct reading gage gives rapid response (less than ½ sec) for laboratory or production instrumentation. Unique design includes such features as noble metal thermopiles and nickel-plated pickup tubes. The nickel-plated pickup tubes afford freedom from outgassing, system contamination, and corrosion. As many as five stations per standard selector unit may be connected to each indicator. Matched gage tubes eliminate the need for additional adjustment when switching. The calibration is not affected by exposure to atmospheric pressure or changes in ambient temperature and there is no need to reset the current each time the pressure changes.

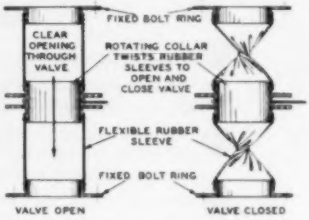
15—COOLANT EQUIPMENT FOR SPINDLE DRILLS

Delta-Milwaukee coolant equipment is now among the 1300 power-tool accessories supplied by the Delta Power Tool Div., Rockwell Mfg. Co. Delta engineers point out that the coolant pump and tank are

highly adaptable and can be used on most wet machine tools. A single unit meets the needs of a multiple-spindle drill press up to 8 spindles. The pump is mounted directly to the tank with a flat machined flange—no piping is required from the pump to the tank. A six-bladed impeller is connected directly to the motor shaft. Several pump models are available that deliver from 6 to 32 gpm when operated with a ¼-hp motor.

16—TWIST VALVE HAS POSITIVE SEAL

Stephens-Adamson Mfg. Co. has developed a double-closure bin valve that consists of two rubber sleeves joined by a rotating steel collar. By pulling on a cable wrapped around the

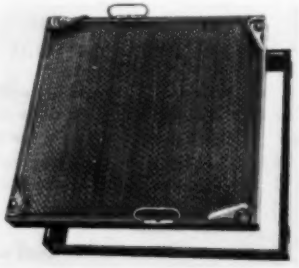


rotating collar the opening is sealed with a twist in each of the rubber sleeves. The valve is self-opening, as the sleeves resume their cylindrical shape after tension on the cable is released. The valve can be hand controlled by a ratchet lock, which holds the cable in the closed position. Remote hand control is possible at any desired location by running a control cable through a simple pulley arrangement. The valve can also be controlled automatically by the use of a small actuating motor. The standard 6-in. valve weighs 35 lb with the ratchet cable-lock mounted on the valve frame. Lump sizes up to 2 ½ in. can be handled with a 30 lb pull for closure.

For more information use one of the convenient reply cards on page 117. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you.

17—AIR FILTER MADE OF CORRUGATED STRIPS

A high velocity unit air filter has just been introduced by the American Air Filter Co., Inc. It is made of corrugated strips of fine mesh wire in which the corrugations taper so that when two strips are placed together they form a series of pyramid shaped

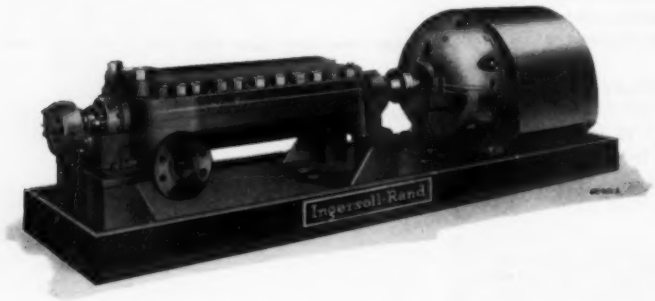


pockets. The small ends of the pockets are closed to the air flow to eliminate any open air passages through the media. Designed to operate at velocities up to 500 fpm, they maintain a uniformly high cleaning efficiency over a wide range of air velocities. Servicing is in the conventional way with washing and charging tanks or reconditioned by washing out the accumulated dust with a hose and spraying with filter adhesive.

(Continued on page 21)

14—CENTRIFUGAL PUMP OPERATES AT 1200 PSI

Ingersoll-Rand Co. has announced a line of multi-stage centrifugal pumps for high-pressure applications to 1200 psi and capacities to 1600 gpm. Known as the Class HMTA, these pumps are exceptionally efficient, easy to maintain and dependable. Applications cover a wide range of boiler-feed, pipe-line pumping and refinery as well as other general high-pressure industrial services. Features contained are: cylindrical-bore, horizontally-split casing and compact rotor assembly.



You Save on 4 Counts with

ENCO

STREAMLINED BAFFLES

1 Better heat transfer

Enco's improved baffle design insures a uniform, high velocity gas flow over every square foot of heating surface.

2 Low draft loss

Smoothly curved baffles maintain a cross-flow of gases across the tube banks. Dead gas areas, bottlenecks and eddy currents are eliminated.

3 Less steam, less time for cleaning

Soot doesn't get a chance to accumulate in pockets. Soot blowers are used less often. Streamlined baffles lower maintenance costs.

4 Custom installation

Experienced Enco crews take charge of the installation, repairs and replacements of your individually designed streamlined baffles—do the job thoroughly and quickly with minimum downtime.

BULLETIN BW44 tells the full story, contains complete engineering data, explains how Enco Baffles provide maximum steam output with minimum fuel consumption. WRITE FOR YOUR FREE COPY TODAY!

THE ENGINEER COMPANY

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IN CANADA: P. J. RASKIN, LTD., 4220 IBERVILLE ST., MONTREAL 34 P.Q.

Read how this

DETROIT ROTOSTOKER

fulfilled these

ECONOMY REQUIREMENTS

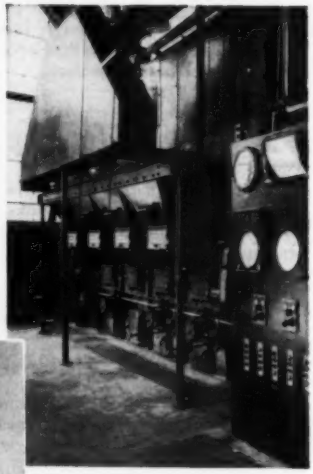
1 Continuous capacity.
2 Ability to handle wide range of coals.
3 High efficiency.
4 Ability to handle fluctuating loads.
5 Minimum labor.
6 Compact arrangement.

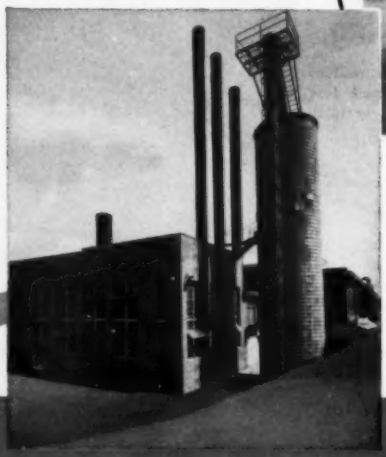
Modern Boiler Unit Serves Hanes Dye and Finishing Company Winston-Salem, N. C.

High efficiency Single Unit Boiler handles wide load swings, provides increased capacity, and saves 20% in fuel in a North Carolina plant.

By Ralph P. Hanes, President and W. O. Sprinkle, Plant Engineer

Send for This Article



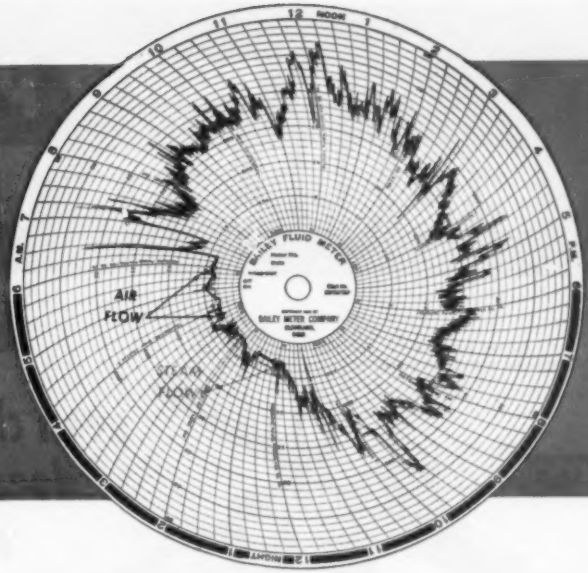


Detroit RotoStoker Power Dumping Type in the Hanes Dye and Finishing Company Boiler Plant.

DETROIT SINCE 1898 STOKERS

Talk About Range

Typical 24 hour steam flow — air flow chart from Hanes plant. RotoStoker handles wide range of load fluctuations.



Hanes Dye & Finishing Co.
Winston-Salem, N. C.

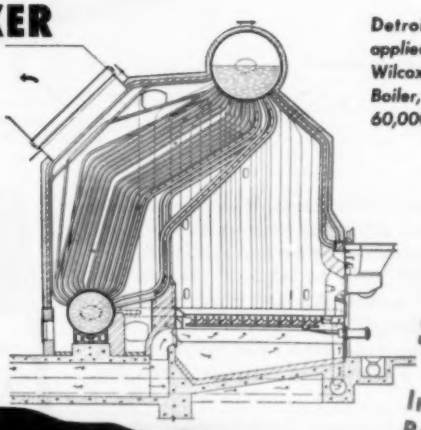
gets results with

DETROIT ROTOSTOKER

With a modern boiler Detroit RotoStoker accomplishes a three-fold saving: Fuel saving was 20%; steaming capacity was increased 20% to a 60,000 lb. per hour maximum; the new generating unit occupies 37% less space than four old boilers it replaced.

Detroit RotoStoker follows load fluctuations of 12 to 1, in a 24 hour period, interspersed with sudden swings over a wide range, with close automatic control of pressure as a routine operation.

The Detroit RotoStoker is a money saver. Write for copy of the Hanes Story.



Detroit RotoStoker—applied to Babcock and Wilcox Integral Furnace Boiler, capacity up to 60,000 pounds of steam.

Other Types and Sizes of DETROIT STOKERS for Every Industrial or Power Need

DETROIT STOKER COMPANY
GENERAL MOTORS BUILDING DETROIT 2, MICHIGAN
Branch Offices in Principal Cities
Works at Monroe, Michigan

New power play for FOULED TUBES

SIMPLE ROTARY INTERNAL SCAVENGER SEAL
STURDY MAN-SIZED HANDLES
MANUAL VALVE LOCK
TWIST GRIP FEATHER VALVE CONTROL
SECTIONAL OR ONE PIECE SHAFTS UP TO 20 FT
GREATER AIR OR WATER SCAVENGER CAPACITY
TWO LIP CARBIDE TIPPED BITS

WILSON

MODEL TP-301

even cleans plugged tubes ...does regular jobs faster AT LESS COST

After long research and field tests, Wilson now brings you the fastest, most economical straight tube cleaner on the market for refinery and process heat exchangers. The improved Model TP-301 is the only tube cleaner which can immediately remove deposits from completely plugged heat exchanger tubes. No matter how badly tubes are fouled, the Model TP-301 puts equipment back "on stream" with a minimum of manpower and a few hours work.

See the important advantages of this improved Model TP-301 Tube Cleaner in the diagram above and the panel at right. Send today for details, giving your specific requirements.

THOMAS C. WILSON, INC.
21-11 44th AVENUE, LONG ISLAND CITY 1, N. Y.
IRONSIDES 6-3360 CABLE "TUBECLEAN" NEW YORK
REPRESENTATIVES IN ALL PRINCIPAL CITIES

Additional New Features of Fast-Acting WILSON TUBE CLEANER

- More powerful
- Lighter weight – only 15 lb
- Shorter—only 13" overall
- Increased capacity – from ⅜" up to 2½" or even 3" O.D. tubes
- Will operate on air pressure as low as 50 lb
- Costs less than previous models

WILSON

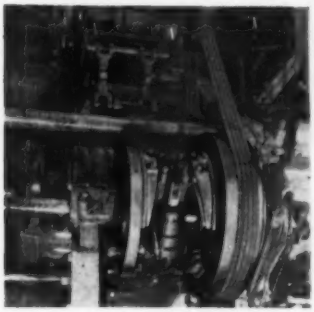
TW-704

WILSON TUBE CLEANERS • WILSON-DUDGEON TUBE-EXPANDERS

(Continued from page 16)

18—FRICTION CLUTCH AND BRAKE AIR POWERED

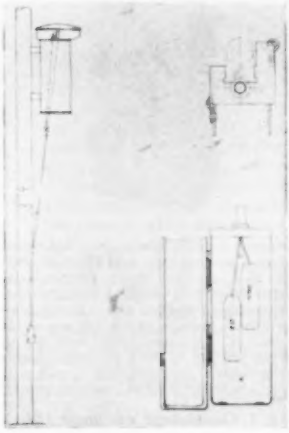
Combination friction clutch and brake unit that is powered for driving medium and heavy machinery has been developed by Power Presses, Inc. Accessibility is the primary feature leading to major savings in down-time and maintenance labor because



(1) shoe and lining assemblies can be changed in minutes rather than hours, (2) such changes can be made without removing the unit from the machine and (3) all other wearing parts—driving mechanism, pistons, piston packings, springs—may be removed while the clutch is mounted on the machine, without the use of special tools and necessity of removing other parts. Maintenance cost is further reduced because wear is virtually limited to the linings. Discs are securely bolted into place, instead of floating in teeth or splines. The basic actuating mechanism is so designed that linings are positively—and automatically—withdrawn from contact with discs, eliminating drag. Bearing wear is minimized by the nature of the design and oversized bearings, which reduce bearing pressure.

19—REMOTE CONTROL CSP TRANSFORMERS

Control device for operating the breaker reset handle of pole mounted CSP transformers from ground level is available from Westinghouse Electric Corp. The device is

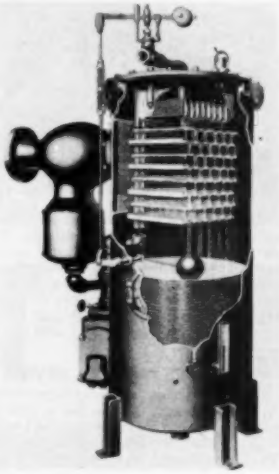


especially useful for turning on and off lighting where power is supplied by CSP transformers. Two control cables are attached to a special bracket mounted on the breaker handle. These run down the pole in conduit and terminate in a control box mounted on the pole at a convenient height above ground. Strain insulators eliminate possibilities of voltage in the control box.

For more information use one of the convenient reply cards on page 117. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you.

20—LOW CAPACITY FEEDWATER HEATERS

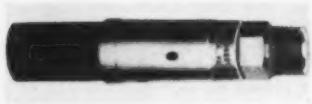
A feedwater heater designed specifically for small manufacturing plants with boiler capacities of 300-hp or less is announced by The Swartwout Co. Known as the Swartwout juinor feedwater heater, the unit



utilizes exhaust steam to heat the water before it is delivered to the boiler. Made of fabricated steel, it has specially designed stainless steel trays, which disperse feedwater in the form of thin curtains over a large area. The exhaust steam gives up heat quickly and evenly. According to the manufacturer, a saving of one per cent in fuel will result from each 10 F increase in feedwater temperature by use of exhaust steam. Ample water storage space eliminates the necessity for a sump or hot well. Condensate returns are piped to the heater for quick reheating to near boiling point.

21—VALVE DESIGNED FOR EXTREME PRESSURES

The patented sealing principle employed in Barksdale Valves was specifically developed for extreme pressure control. It is a pressure balanced, self-aligning, tubular valve seat that keeps perfect intimate contact with the mating surface of an optically flat porting disc. The rotary movement of this disc (or rotor) opens and closes the flow passages. During the absence of fluid pressure a heavy marcel springwasher maintains the contact between sealing surfaces,



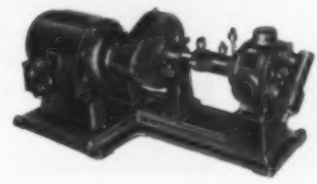
while a predetermined hydraulic force acts on the seal under extreme pressure. Fluid flow is always through the center hole, never across sealing surfaces. This is an important characteristic particularly in the control of dirty high velocity fluids, because it eliminates the problem of scoring and wire drawing. Production models cover a complete range of the following types and pressures: shut-off valves from ¼ to 1½ in. for pressures 0 to 6000 psi, 4-way dual pressure valves in two classes, (1) for 3000 psi maximum pressure, (2) for 6000 psi maximum pressure and manipulator valves from 3/8 to 1 in. for pressures 0 to 1500 psi. The service ratings include all common industrial media such as water, air, hydraulic oil, gas, fuel and petroleum.

22—VINYL BASED PRIMER HAS MANY APPLICATIONS

Casey & Case Coating Company's vinyl based primers, intermediates and finishes are scientifically formulated for application where surface maintenance problems exist, or product contamination is undesirable. Composed of chemically inert thermoplastic resins, to which have been added the necessary solvents, plasticizers and pigmentations, these coatings provide unusually long lasting surface protection. For withstanding severe weathering conditions and combating the corrosive action of acids, acid fumes, alkalies, salts and other corrosive agents these coatings are particularly effective. They are applicable to metals, concrete, stone, brick, stucco, plaster, pumice or other formed blocks, celotex, wallboard and plywood. Brushed on, sprayed or dipped, excessive solvents quickly evaporate, leaving a tough, ductile, non-inflammable, non-combustible and strongly adhesive finish. They are extremely low in water absorption or moisture vapor transmission. Surface finishes are easily cleaned since coatings are impervious to cleaning reagents at temperatures up to 160 F. In consequence these vinyl based coatings have many applications on metal, masonry and plywood structures, on processing equipment and storage units serving all segments of the food, chemical, marine, petroleum and transportation industries.

23—ROTARY PUMPS USED OUTDOORS

Totally-enclosed rotary pumps have been developed by Viking Pump Co., to meet the need for 20, 35, 50 and 92 gpm capacity. Previously these pumps were available only in 200 gpm size. These units are suited for pumping all types of clean liquids, when installed either indoors or outdoors. With oil-tight, water-tight guards, they can be used safely outside in all kinds of weather without a pump house or protection of any



kind, when equipped with a totally enclosed motor. Outstanding features are: (1) oil-tight, cast iron gear case with oil gage, filler and drain plug, (2) combination flange and foot type, bronze bushed bearing, mounted on pedestal for supporting gear case and pump shaft, (3) stainless steel pump shaft. No rusting if exposed to weather, (4) extra long stuffing box on pumps. Rust proof studs and nuts. (5) ball check grease cups on pump and pedestal bearings and (6) when used with a totally enclosed motor, can be installed outdoors without protection.

24—PYROMETER HAS SEALED CONSTRUCTION

Pyrometer equipment, which offers accurate temperature indication, close temperature control of industrial processes and protection for furnaces, ovens and kilns, has been announced by GE's Meter and Instrument Div. The complete line consists of flush- or surface-mounted indicators, controllers and protectors. The instruments have been designed for industrial applications that

include heat treating furnaces; brick, cement or ceramic kilns; melting furnaces, cooking kettles, plastic molding machines, impregnating tanks and cloth-treating ovens. Calibration accuracy is within 3/4 of 1 per cent of full scale. A legible 7-in. scale, fitted with an anti-glare cover, indicates any change in temperature equivalent to 1/10 of 1 per cent of full scale. Heart of the indicating instrument is a 3¼-lb magnet, which provides higher flux density and allows larger air gaps than are found in conventional instruments. Foreign matter will not impair the operation since the indicator is so sealed.

For more information use one of the convenient reply cards on page 117. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you.

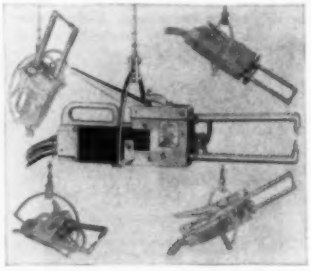
25—SAND BLASTER IS BENCH SIZE

W. W. Sly Mfg. Co., has just brought out a handy sandblast cabinet for cleaning dies,

tools, pistons, piston rings, valves and other small parts. This cabinet is complete, including two light fixtures for illuminating the interior, an exhaust fan and a dust bag for making the operation dustless. Primary use is for cleaning small metal parts with soft abrasives, such as ground corn cobs or nut shells. These will thoroughly remove all surface impurities without scoring the metal. Sand or metal abrasives are adaptable also. It has two rubber sleeves for both arms of the operator, with rubber gloves attached. It measures 14 x 17 in. and can be placed on a work bench, connecting it to a compressed air line and 110-v lighting circuit for lights and exhaust fan.

26—PORTABLE SPOTWELDER EASILY OPERATED

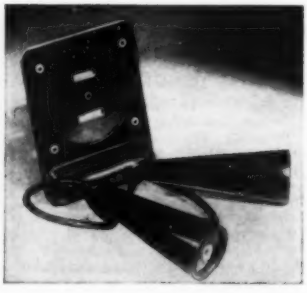
Portable 10 and 20-kva spot welder manufactured by Miller Electric Mfg. Co. can be positioned so inexperienced person-



nel can operate it with ease. The suspension ring is equipped with ball bearings. The unit is low in cost when compared to the conventional gun type "spot" welder, even though equipped with suspension ring. It can be used by sheet metal shops or manufacturing plants. Weight is about 20 lb.

27—POTENTIAL READ WITH CLAMP ON DEVICE

A testing device, announced by Industrial Devices, Inc., allows for a voltage measurement to be made across a load without the usual "breaking in" on the line. This unit consists of a wafer-thin plate, which slips over the prongs of standard Edison plugs and provides two tip jacks that receive standard phone tips. The appliance to be checked is plugged through the potential tap into the power receptacle. An industrial voltmeter with phone tip leads may be used to check the voltage with the appliance on or off. In this manner the voltage drop with the load on may be immediately read, without the fuss and bother of removing the plug from the line and wiring in the instrument.



28—MARKETING MACHINE IDENTIFIES METAL

M. E. Cunningham Co. has just developed a channel marking machine for stamping

trade name, address or other identification on aluminum or other metal channel sections. Although developed specifically for code identifying aluminum storm doors and windows, this equipment can be produced for stamping small steel or aluminum channel sections of practically any shape. A channel section is marked by pulling a handle from left to right. This action rolls a deep, clear-cut mark in the channel without distorting the metal. A spring returns the mandrel to position for the next marking. The roll die can be made with lettering engraved on the solid roll. For part numbers or other changing identification marks, interchangeable type set-ups can be provided. The base or mandrel section is machined to suit individual channel shapes. Mounted on needle bearings, it is made of solid steel for providing a solid stamping surface.

29—LINESTARTER COMES IN SEVEN ENCLOSURES

A combination Life-Linestarter, Class 11-206-N—combining motor starter, motor

protection, and disconnect in a redesigned enclosure to save space and increase safety —is now available from Westinghouse Electric Corp. It is designed for across-the-line starting of squirrel cage induction motors, or as a primary switch for wound rotor motors. Capacities range from ¼ to 100 hp, and 110 to 600-v ploy phase. Available in NEMA sizes 0 through 4, and in 1, 1A, 3, 4, 5, 7 and 9 NEMA type enclosures.

(Continued on page 136)

STOP RUST WITH RUST-OLEUM

Why let rust—the most destructive enemy of American [illegible] — rob you of [illegible], scrap-to-replace machines, tanks, stacks, fences, pipe, metal sash, fire escapes, and other valuable equipment?

Use RUST-OLEUM in your plant to protect your property. For 25 years RUST-OLEUM has proved its capacity to stop rust for many nationally known manufacturers. Its tough, pliable, rust-resisting film gives excellent protection that prevents rust losses under many difficult rust-producing conditions—salt air, dampness, industrial fumes, and general weathering.

RUST-OLEUM can be applied *even* over rusted surfaces. It is not necessary to remove all the rust. Just remove scale and loose rust by [illegible] and wire [illegible] labor on maintenance because no chemical precleaning or sand blasting is usually required.

A qualified RUST-OLEUM specialist will [illegible] rust problems and help you develop a program of plant-wide rust control to defer many costly replacements — to conserve the available supply of new metal for national defense.

Industrial Distributors in principal cities of the United States and Canada carry complete stocks for immediate delivery. Plan your needs—order *now!* See our complete catalog in *Sweet's* which also tells the nearest source of supply. Or, write on your company letterhead for full information.

"RIGID ECONOMY, MON!"

Available in many COLORS aluminum and white

Beautifies as it Protects

RUST-OLEUM CORPORATION
2473 Oakton Street, Evanston, Illinois

new bulletins and catalogs

Be sure to order your free copy of these booklets—they're the latest information published by leading manufacturers. Use the postage-free order cards on Page 117. Just list the Key Numbers of the bulletins you want in the spaces provided on cards

BOILERS, AUXILIARIES, ACCESSORIES

200—Packaged Steam Generators. Over 110 years of boiler building experience stand behind this new conception of packaged water tube steam generator. Colorful 8-page folder shows all the details of the 2-drum, 3-pass Keystone. Dimensions and capacities for the 13 sizes (75 to 800 hp) are given in tabular and diagrammatic form. Cutaway views show design and construction features. Bulletin unfolds to make one page showing enlarged views of the boiler with all equipment identified. Erie City Iron Works.

201—Soot Blower. Proven by performance under severe conditions on marine boilers is this newcomer to the stationary field. Design features of rotary, soot blower head that assures better boiler cleaning, ease of operation, long and dependable service, and low maintenance are pictured and described in 4-page bulletin. Diagrams show how simple it is to service and maintain the unit. Vulcan Soot Blower Div., Continental Foundry & Machine Co.

202—Burners. Series CBM combination gas and oil burners provide approximately the same heat pattern when firing either or both fuels in combination says 4-page bulletin. Other features are described and diagrams show sectional views along with installation data. John Zink Co.

203—Purifier Selection Manual. Solve your separation (entrained solids from moving steam, air, gas, and vapor) needs with the formulas contained in 8-page manual. Means of calculating volume, actual flow, velocity, pressure drop, etc., are described in sequence. Convenient index includes the terms used in the formulas, molecular weights of gases and vapors, and miscellaneous data. Charts show you how to translate the results into purifier sizes. Centrifix Corp.

204—Refractories. New refractory does the "impossible" according to 12-page technical bulletin on the unusual properties of Norton Fused Stabilized Zirconia. Some features are: withstands temperatures up to 4500 F; insulates effectively at high temperatures; withstands severe thermal shock. Booklet gives all the up-to-the-minute facts. Shows photos of the various shapes available. Norton Co.

205—Pulverized Coal Firing. Of particular interest to design engineers and coal consumers is this 6-page house organ dealing with the advantages of pulverized coal firing. Design procedure, pulverizers, furnace, burners, accessories and operation are thoroughly discussed. Tables, curves and drawings are included. The Pittston Co.

206—Spreader Stokers. Complete line of underfeed and overfeed spreader stokers are covered in bulletins now available. Economy and dependability along with features developed over the past 50 years are embodied in the various designs. Burn all grades of coal without expensive preparation. Efficiencies and capacities of your present boiler may be raised to new standards through the use of stokers according to the bulletins. Detroit Stoker Co.

207—Burners. Combination gas and oil burners, designed for boilers and process furnaces where maximum heat release at low excess air and high heat density place a premium on reliable burner performance, are covered in 4-page bulletin. Series Y and YC burn any commercial fuel oil and any gas at reasonable pressure says 4-page bulletin. Other features along with a sectional drawing and a Btu capacity curve given. John Zink Co.

208—Electrode Steam Boilers. Let Speedylectric put steam to work for you. Designed to hold exact steam pressure and temperature, this line of electrode steam boilers is briefly described in 4-page folder. Refers you to bulletins for more specific information. Pressures up to 500 psi and volumes to 750 lb of steam per hr. Steam-jet cleaners also shown. Livingston Engineering Co.

209—Feedwater Heater. If you operate a power plant of 300 hp or less you will be interested in this junior-size all-steel feedwater heater. 2-page bulletin gives all the details. Photographs, cutaway views and dimensional diagrams illustrate the bulletin. The Swartwout Co.

210—Steam Specialties. Complete descriptive matter on steam and air traps, pressure reducing valves, pump governors, pressure regulators, boiler feed controls and temperature regulators is contained in 33-page catalog. Included are such data for sizing this equipment as trap capacity tables, reducing valve selection charts, reducing valve capacities etc. The C. E. Squires Co.

PRIME MOVERS: DIESELS, TURBINES, COMPRESSORS

211—Portable Compressor. Rotary compressor, using a new advanced design, delivers full 600 cfm at 110 psi although weighing only 9500 lb, according to 8-page folder. No valves, no pistons or rings, no rod bearings, no vibration, no clutch—these and other features showing the simplicity of design, operation and maintenance are listed. Matched to two-cycle 6-cylinder General Motors Diesel engine. On-the-job photos and case histories are included. Ingersoll-Rand Co.

212—Turbine-Generators. Turbine-generators (500 kw and above) are covered in 40-page bulletin that pictures and describes nearly 50 installations, both utility and industrial. Brief discussions of generator and exciter cooling methods are included. Detailed drawing shows a typical turbine-condenser installation arrangement. Dimensions and weights of standard units are tabulated. Turbine Div. Elliott Co.

213—Machinery. Nordberg's new 28-page bulletin lists all types of machinery produced by them. Fully illustrated with installation and product photographs, the booklet also gives design data on two and four-cycle diesel engines, crushers, screens, compressors, mine hoists, grinding mills and railway track maintenance equipment. Various applications listed. Nordberg Mfg. Co.

214—Gas-Engine Compressors. Heavy-duty, four-cycle V-type gas engine with either 6 (330 hp) or 8 (440 hp) power cylinders and a horizontal, crosshead type, double-acting compressor combined in a single frame is described in 8-page bulletin. Lists 30 improvements added to older models. Application recommendations are given along with complete specifications and dimensions. Photos and cutaway views illustrate the book. Ingersoll-Rand Co.

WATER AND LIQUID TREATMENT

215—Softener. Precipitating softener and coagulator, in which energy for floc preparation is mechanical, is thoroughly described in new bulletin. Flow charts illustrate a discussion of the flow circuit. Chemical feeders, dual purpose pump and chemical proportioning system are pictured and described. Worthington Pump & Machinery Corp.

216—Recooling Spray Nozzle System. Are you operating condensers or using large quantities of water for cooling? Then you'll want to get this 8-page bulletin that details design, application,

(Continued on page 26)

You get MORE CAPACITY with a FANMIX BURNER

Increase Boiler Ratings On Present Or Planned Equipment

In all types of Coppus-Dennis FANMIX Burners — straight gas or combination gas-oil — we utilize the energy of the fuel under pressure to drive the burner fan and deliver air in the proper proportion to the fuel flow. This exclusive "pinwheel action" *mechanically* mixes fuel and air in exactly the right proportions for truly radiant, non-luminous heat.

The result is uniform temperature everywhere in the combustion chamber — no drifting "hot spots" — and complete combustion under all conditions. That's why you can release more heat into your present furnace — why in new installations you get more heat into smaller furnace space.

FANMIX Saves On Both Old and New Installations

FANMIX can easily be operated with your present furnace and stack, requiring only minor changes in other equipment. Or if you're planning on new boilers, remember that FANMIX relieves the furnace from the burden of mixing, creates its own forced draft and takes smaller pipe sizes. Which means you can plan on reduced combustion space, less stack, no forced draft equipment and lower installation costs all around.

Get the Whole Story

Coppus engineers FANMIX Burners to meet individual requirements, providing complete control over heat pattern and combustion . . . Learn more about how "pinwheel action" can step up *your* boiler performance to peak efficiency and economy — as it is doing throughout industry. Send for Bulletin 410-6. Coppus Engineering Corp., Worcester 2, Mass. Sales Offices in THOMAS' REGISTER. Other Coppus "Blue Ribbon" Products in BEST'S SAFETY DIRECTORY, CHEMICAL ENGINEERING CATALOG, REFINERY CATALOG, and MINING CATALOGS.

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(Continued from page 24)

construction and operation of spray nozzles. Diagrams typical spray pond arrangements. Tables show sizes, dimensions, capacities and spray nozzle patterns. Graph gives cooling performance curves for various temperature ranges using 7 psi at the nozzle. Atmospheric conditions, and operating pressures are also discussed. Schutte & Koerting Co.

217—Corrosion Inhibitor. Manner in which corrosion inhibitor acts by neutralization and by surface adsorption to control the corrosion of steam and condensate lines is described in 2-page leaflet. Proper application methods are given. Offers testing service and an estimate of the daily cost of the material. Allis-Chalmers Mfg. Co.

218—Filter-Clarifier. Does your processing require a crystal-clear filtrate? 4-page bulletin gives you operating principles, typical performance data, capacities and advantages of filter-clarifier. Not a backwash type, but uses, instead, a spiral scraper that takes a cut off the sand bed when the filter rate decreases. Hardinge Co., Inc.

219—Centrifuges. Almost all modern industrial processes have the problem of continuously and economically handling large quantities of slurries and suspensions. Here is a 12-page bulletin to help solve your problems. Explains operating principles and applications for two types of high speed horizontal centrifuges. Cutaway drawings as well as installation photos illustrate the booklet. The Sharples Corp.

220—Dry-Fan Cooling Towers. Mechanical draft cooling towers in a capacity range of 3 to 30 tons of refrigeration are illustrated anl described in 4-page bulletin. Gives full information on construction features along with sectional views that illustrate the advantages. Selection table, performance data table, and dimensions table along with a series of step-by-step installation photographs are included. Binks Mfg. Co.

221—Boiler Water Tests. Quick method for conductometric determination of solids in boiler water or condensate is described and illustrated in 6-page bulletin. Shows equipment which includes conductivity meter, dial thermometer, conductivity cylinder and reagent. Gives basic principles, ranges, procedures, and checking and maintenance practices. Hall Laboratories, Inc.

ELECTRICAL EQUIPMENT

222—Watthour Meters. Fundamentals of a-c metering are comprehensively covered in 40-page manual. Illustrated with charts, diagrams and photos, the booklet shows how electric energy is measured; describes operating principles and explains techniques involved in using, testing and maintaining meters. General Electric Co.

223—D-C Motors & Generators. 19-page booklet describing the Life-Line type SK d-c motors and generators shows how a new design uses rolled steel frames, heavy steel brackets and prelubricated double-sealed ball bearings to provide long life without outages. Also pictures and discusses unit construction of field coils for ease of replacement; use of Tufvar insulated conductors in the armature; unique construction of the end turns that prevents localized heating. Types, enclosures, and mountings for many applications are listed. Westinghouse Electric Corp.

For more information use one of the convenient reply cards on page 117. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you.

224—Bushing Standardization. More than 1000 different types of G. E. transformer and circuit breaker bushings have been replaced with 38 standard bushings according to 12-page bulletin that announces a bushing standardization program. Tables show bushings, now in service, which can be replaced by the listed 38 standard bushings. Lower prices, faster delivery and smaller inventories on types rated from 15-kv to 230-kv inclusive, 1200 amp and below, are some of the advantages claimed. General Electric Co.

225—Solderless Connectors. UL-approved connectors for solderless splicing and terminating of electrical wires are tool and time savers claims 4-page bulletin. Contains detailed descriptive data, installation instructions and ordering information. Buchanan Electrical Products Corp.

INSTRUMENTS, CONTROLS, RECORDERS

226—Dynamometer Scales. Most any type of dynamometer scale for measuring tension and force may be found in 14-page bulletin that illustrates and describes the various models manufactured by this maker of precision springs. Features, applications, tolerance tables, capacities and dimensions are included as are diagrams and cutaway views showing the working parts. John Chatillon & Sons.

227—Moisture Meter. Fast, accurate, self-contained, midget moisture meter, as described in 6-page bulletin, measures moisture content of wood, plaster and wood products by the electrical resistance method. Just touch a button and read your per cent moisture. Design and construction features are described and the varied uses are explained. Tagliabue Instruments Div., Weston Electrical Instrument Corp.

228—Instruments. Temperature and pressure instruments including industrial thermometers, accessories, recording thermometers, recording pressure gages, panel boards, air-operated temperature and pressure controllers, diaphragm motor valves, and pressure gages and regulators are listed and illustrated in 56-page catalog. Specifications along with general data on each unit are included. H. O. Trerice Co.

229—Feedwater Control. Straightforward, concise discussion of problems encountered in feedwater control and how to help solve them with air-operated, three-element system is contained in 16-page bulletin. Diagrams, cutaway views, typical chart records and photographs of modern installations are used to aid in describing the latest developments in the control system. Bailey Meter Co.

230—Liquid Level Gages. Float, pressure bulb, pressure, counterpoise, differential pressure, and air-bubbler types of liquid level gages for a variety of uses are described in 24-page bulletin. Applications include the measurement and automatic control of water and other liquids, whether flowing, turbulent, corrosive, under static pressure, covered with ice, or carrying solid matter. Also contains information on remote recording and remote automatic pump control of water level. Photographs and drawing supplement the technical data. The Bristol Co.

MATERIAL HANDLING

231—Magnetic Pipeline Trap. Protect your equipment from tramp iron with pressure-tight device used to remove tramp iron from pipelines carrying liquids and semi-liquids. 2-page bulletin lists complete description, specifications, construction features, and various advantages. Eriez Mfg. Co.

232—Flat-Top Conveyer Chain. Dimensions and pertinent data on light, durable, efficient, flat-top conveyer chain and its cut tooth sprocket wheels are given in 4-page bulletin. Various design and construction features are listed and pictured. Engineering data include formulas used in calculating chain pull and hp requirements. Link-Belt Co.

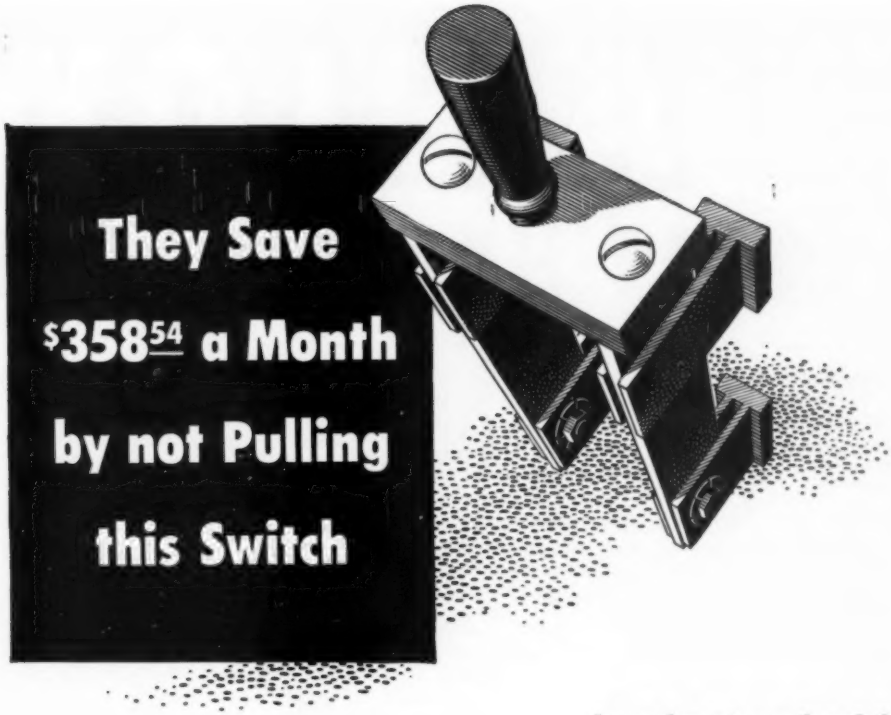
233—Sling Chains. Wrought iron sling chains are the subject of 4-page booklet. Gives safety rules and full data on inspection, use and care. Recommended load limits are listed in detail. Specifications are presented in tabular form. Cleveland Chain and Mfg. Co.

234—Conveyer & Elevator Belts. 26-page catalog section describes all belt features, explains why increased service life with decreased maintenance are made possible by the construction. Tells the function which each part of the belt performs, as well as other significant data. Illustrations show construction features in detail. The B. F. Goodrich Co.

235—Car Shaker. Construction details along with specifications and a cross section through the vibrating mechanism are given in 6-page bulletin describing car shaker for unloading granular material from hopper-bottom gondola cars. Lists typical applications along with specifications and gives general information on installation and maintenance. Allis-Chalmers Mfg. Co.

236—Jaw Crushers. Principles of "crushing without rubbing" are graphically presented in 12-page bulletin.

(Continued on page 30)



They Save $358.54 a Month by not Pulling this Switch

Every day the machinery in a Clinton, Mass. plant* had to be stopped for a half hour while those machines were lubricated. Every stop meant lost production time plus a $14 expenditure for lubrication.

The Clinton people called in an Alemite Lubrication Engineer. They wanted to know if they could eliminate the costly interruption in production time. They felt that lubrication was costing them too much.

The Alemite Lubrication Engineer studied their problem and recommended a system that automatically lubricates the machinery without any shut-down. What's more, lubrication cost was cut from $14 a day to only 21c a day. That saving alone paid for the entire investment in just 43 days.

Call Your Alemite Lubrication Engineer

No matter what size or type of plant you operate, Alemite can show you dozens of ways to save through the more efficient handling of petroleum products. Call your local Alemite Industrial Distributor now or send for the free booklet "11 Ways to Cut Production Costs." Simply attach the coupon below to your letterhead. Dept. M-31, 1850 Diversey Parkway, Chicago 14, Ill.

*Name on request.

ALEMITE

MEANS EVERYTHING FOR LUBRICATION

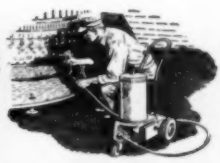
1. Methods 2. Lubricants 3. Equipment

Another Product of Stewart-Warner

Alemite Cuts Costs 3 Ways

1. In transferring lubricants... cuts man hours 63⅓% for every 100 pounds transferred. No mess, no contamination.

2. In loading grease guns... saves 3¾ man hours for every 100 pounds of lubricant loaded into hand guns.



3. In applying lubricants... saves up to 23.9 man hours for every 100 pounds of lubricant applied to bearings.

FREE! Valuable booklet—
"11 Ways to Cut Production Cost"
(Simply attach to your letterhead)
ALEMITE, Dept. M-31
1850 Diversey Parkway, Chicago 14, Ill.

We'll include facts on the new Alemite Oil-Mist System, too—(OIL-MIST atomizes oil into mist, circulates it to bearings under pressure. Increases life of bearings as much as 17½ times).

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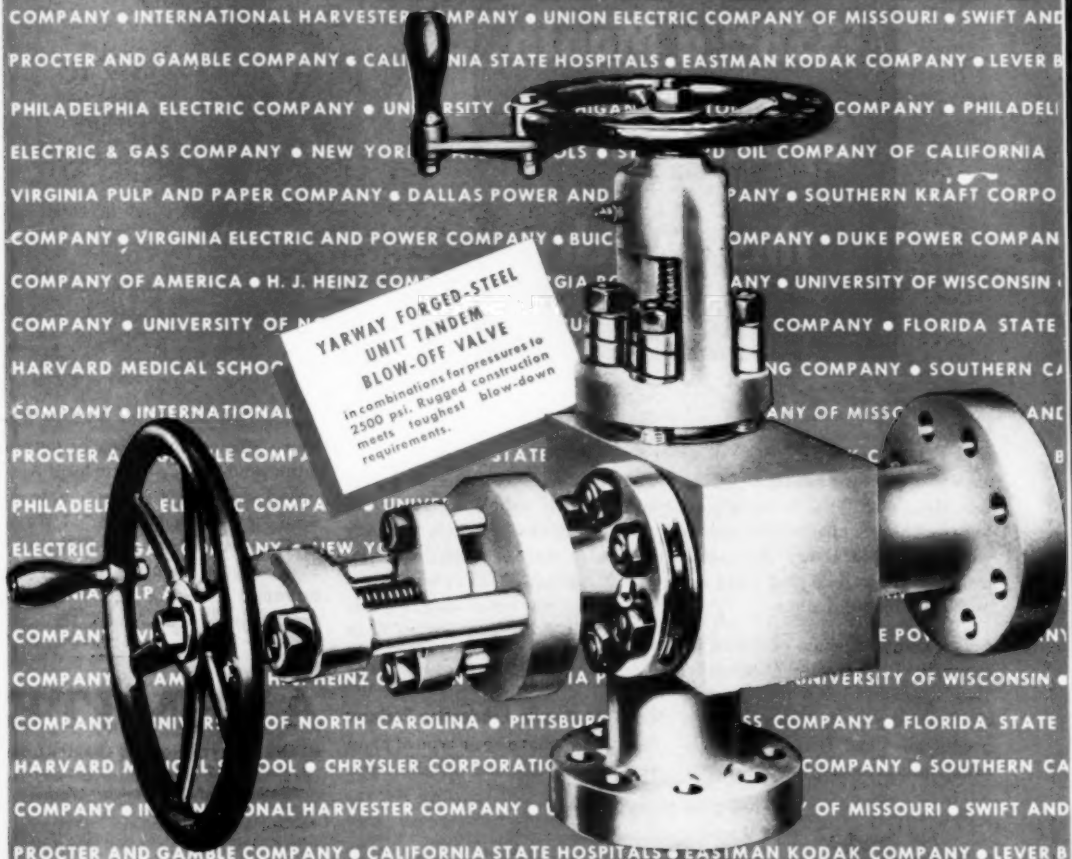
A BLOW-

IS KNOWN BY THE


YARWAY FORGED-STEEL
UNIT TANDEM
BLOW-OFF VALVE
in combinations for pressures to 2500 psi. Rugged construction meets toughest blow-down requirements.

YARWAY

OFF VALVE
BOILERS IT PROTECTS

When buying blow-off valves, weigh the significance of these two facts:

More than 15,000 boiler plants in the United States and other countries are equipped with Yarway Blow-Off Valves . . . Some of them for nearly 40 years. *Among high pressure plants, 4 out of every 5 in the United States are Yarway-equipped.*

Design, metallurgy, workmanship and service are the reasons. It was Yarway that brought out the famous Seatless Valve, teamed it with a stellited hard-seat valve in a common forged-steel body to make the popular Unit Tandem. Yarway has also made available metallurgical improvements to withstand the chemical reactions of acid wash as well as the mechanical wear of boiler blow-down.

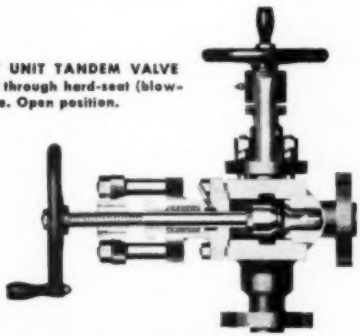
Yarway continues to pioneer and improve blow-off valves and blow-off valve service for both high and low pressure applications.

On new boilers, replacements or modernization, make sure you specify Yarway Blow-Off Valves. Any boiler manufacturer will supply them on your specification.

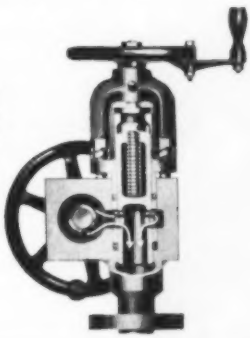
Bulletin B-424 gives you the full story on pressures to 400 psi. Bulletin B-433 for higher pressures. Both are free. Write . . .

YARNALL-WARING COMPANY, 109 Mermaid Ave., Philadelphia 18, Pa.

YARWAY UNIT TANDEM VALVE sectioned through hard-seat (blowing) valve. Open position.



YARWAY UNIT TANDEM VALVE sectioned through seatless (seating) valve. Open position.



Standard Swivel Joints For pressures from 125 psi to 15,000 psi.

High Temperature Swivel Joints For temperatures to 600° F. M.W.P. 300 psi.

Rotating Joints For 150-lb. steam, brine, etc.

Sanitary Swivel Joints For Food Processing, Dairies, etc.

Hydraulic Swivel Joints For pressures to 3,000 psi.

DESIGN

There is No Substitute for Experience CHIKSAN

MANUFACTURE

APPLICATION

Only with CHIKSAN **Ball-Bearing** Swivel Joints* can you benefit from a quarter-century of **specialized experience** in the development, design, manufacture and application of Swivel Joints for all purposes. CHIKSAN'S resources, facilities and personnel are **concentrated exclusively** on the production of Swivel Joints and their application to all kinds of installations. This is your assurance of efficient performance, long life and low-cost maintenance. There is no substitute for CHIKSAN!

CHIKSAN Engineers will gladly cooperate with you in selecting the correct Types and Styles of Swivel Joints for your particular requirements...and in specifying the proper Packing Unit for the fluid you handle. This valuable, experienced counsel costs you nothing.

*For full 360° rotation in 1, 2 and 3 planes. Unlimited flexibility in pipe lines can be secured simply by arranging swivels in proper sequence.

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CHIKSAN EXPORT CO. BREA, CALIFORNIA NEWARK 2, N. J.

BALL-BEARING SWIVEL JOINTS FOR ALL PURPOSES

(Continued from page 26)

General description of the mechanism with detailed diagrams is given along with installation data. Tables show capacity ratings, power, weight, etc. Pennsylvania Crusher Co.

POWER TRANSMISSION

237—Gear Coupling. Spline or gear type coupling designed to handle shaft misalignment up to 7 degrees is the subject of 6-page bulletin. Drawings and cutaway views show how the dihedral surfaces of gears provide maximum bearing area and handle maximum misalignment with minimum clearance on backlash. Selection table makes it easy to choose the correct size coupling. Recommended applications are listed and engineering service for special installations is offered. Ajax Flexible Coupling Co., Inc.

238—Bearing Maintenance. Eliminate your "down time" lost through bearing failure due to faulty maintenance practices. The first pamphlet of a continuing study of bearing maintenance techniques and successful maintenance, installation and removal procedures is now available. Succeeding issues will present all available maintenance information on every type of bearing. Can be compiled in binder that accompanies the first pamphlet. The Anti-Friction Bearing Distributors Assoc.

For more information use one of the convenient reply cards on page 117. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you.

239—Chain Drive Handbook. Helpful information for engineers and maintenance men is contained in new handbook and catalog. Packed with suggestions on how to install, maintain and operate roller chain. Tells how to plan chain drive layouts and offers hints on lubrication and roller chain selection. Also includes length conversion tables, hp rating charts, and specifications for all types of roller chain and extended pitch conveyer chain. Atlas Chain & Mfg. Co.

240—Worm Gear Speed Reducers. Series of case histories comprise 8-page booklet that demonstrates the varied applications of the right-angle drive worm gear sets and speed reducers. Shows different sizes and models including fan-cooled type. The Cleveland Worm & Gear Co.

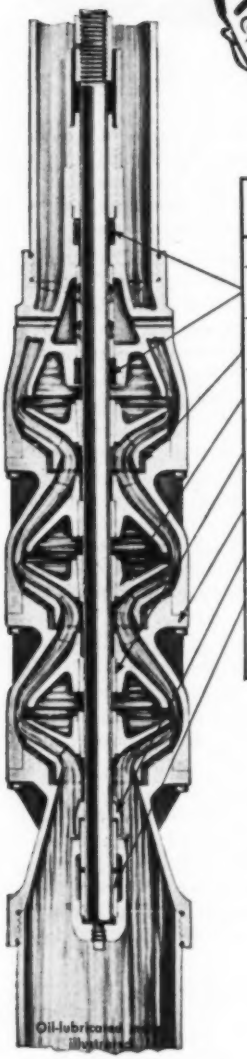
241—Speed Control Equipment. From 3 basic units Reeves builds a complete line of speed control equipment that is simply designed, ruggedly built and easily maintained according to 12-page bulletin. All are adaptable to new machine designs or may be installed on machines already in service. Over 2000 different makes of machines now employ the units as standard equipment. Booklet contains discussion of features and operating principles along with tabulations of hp ratings and dimen-

(Continued on page 33)

Before you buy a vertical turbine pump

CHECK WORTHINGTON AGAINST THE FIELD!

Chart shows only Worthington gives you all 8 vital design-features as standard equipment



The Ten Leading Makes Of Vertical Turbine Pumps
√ Indicates Feature Is Standard

Standard Features	Worthington Type Q	Pump A	Pump B	Pump C	Pump D	Pump E	Pump F	Pump G	Pump H	Pump I
Seals above and below drain ports (oil-lubricated model)	√									
Wearing rings	√				√			√		
Enclosed impellers	√	√	√	√	√	√		√	√	√
Bronze bushings in bowl assembly	√		√	√	√	√		√	√	√
Flanged and bolted bowls on all sizes	√						√		√	√
Sand collars at both ends of bowl assembly (water-lubricated model)	√	√								
Grease-packed bottom bearing	√	√			√					√
Choice of oil or water lubrication	√	√	√	√	√	√		√		

There's your quick, complete picture of how Worthington Type Q stocks up against competition. Remember — each of the features listed is a proved aid to more efficient pump performance. And only Worthington gives you all of them as standard!

Why settle for anything less than this all-inclusive, ahead-of-the-parade design that assures smoother, lower-cost pumping?

Maximum Head In All Sizes

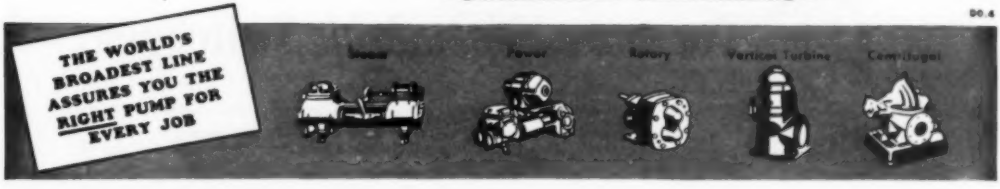
Available in sizes from 6" to 32", Worthington Type Q Vertical Turbine Pumps handle liquids at temperatures of 7° below zero F to 500°F, with maximum head per stage over the entire size range.

See your local Worthington dealer for the whole story that proves *there's more worth in Worthington*. Complete manufacturing and servicing facilities at Denver, Colo., and Harrison, N. J. *Worthington Pump and Machinery Corporation, Harrison, N. J., Denver 16, Colorado.*

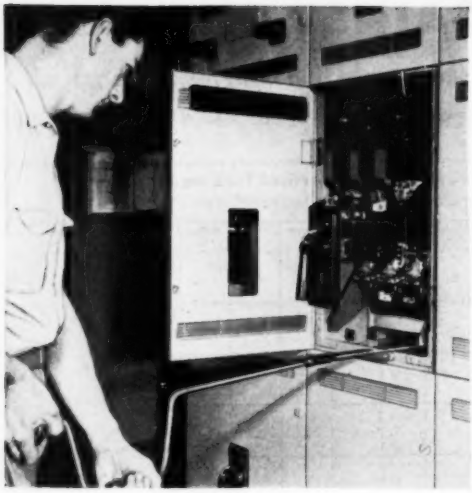
Dealer Franchises Open

WORTHINGTON

D0.4



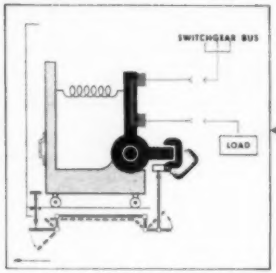
I-T-E SWITCHGEAR GIVES YOU *DOUBLE PROTECTION*



Have you ever considered the results of a sudden loss of power in your plant—lights going out, machines stopping, possible injury to personnel? It could be a trying and costly experience, particularly if it could easily have been prevented!

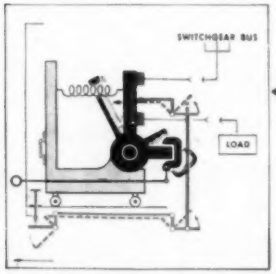
The purpose of your switchboard is to minimize power shutdowns and protect equipment and personnel. I-T-E switchboards do these things and much more. They offer you *double protection*—because mechanical interlocks of a design unique with I-T-E protect the drawout circuit breakers which in turn protect your power distribution system.

A mechanical interlock prevents the circuit breaker from being connected to or disconnected from line and load connections *unless the breaker's contacts are open*. If this is not accomplished, withdrawal of the circuit breaker would cause arcing at the disconnect device, probable subsequent damage to the equipment, power loss and injury to personnel.



The interlock by "deduction"

The ordinary interlock works by "deduction": that is, movement of the interlock's mechanical linkages disengages the latch which holds the breaker in a closed position. The breaker's contacts *should* then be open, but the breaker may then be moved in or out whether or not the contacts are actually open.



The interlock by I-T-E

On the other hand, I-T-E's interlock is safe, sure, simple. This interlock mechanism is connected directly to the arm which carries the movable contacts. Unless the breaker has been fully opened by a separate manual tripping action, it *cannot* be moved into or out of line and load engagement.

The I-T-E interlock is a simple but important feature. Your operator's life and your plant's safety may depend on it. It's just one more reason why *I-T-E is your best switchgear buy!*

For more information about I-T-E Multumite Switchgear, send for bulletins 6C03-D and 7000-A.

For *more dependable* Switchgear

specify I-T-E!

I-T-E Circuit Breaker Company, 19th & Hamilton Sts., Philadelphia 30, Pa.

Power Switchgear Equipment: Railway and Industrial Engineering Co., Greensburg, Pa.
Canadian Mfg. & Sales: Eastern Power Devices, Ltd., Toronto • Export Sales: Philips Export Corp., New York

SWITCHGEAR • UNIT SUBSTATIONS • ISOLATED PHASE BUS STRUCTURES • CIRCUIT BREAKERS • MECHANICAL RECTIFIERS • RESISTORS • SPECIAL PRODUCTS

(Continued from page 30)

sions. Controls and indicators—both standard and extra—are pictured and described. Two pages of general engineering information round out the book. Reeves Pulley Co.

242—Cut-Out Couplings. Automatic device that instantly shuts off the power when any kind of overload occurs is introduced in 12-page catalog. Offers torque sensitive protection combined with the features of a flexible coupling, says the booklet. Full description along with a discussion on the many possibilities included. Anchor Steel and Conveyor Co.

For more information use one of the convenient reply cards on page 117. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you.

243—Fluid Power Equipment. Complete line of fluid power pumps, motors, transmissions, cylinders and valves is featured in 8-page bulletin. New lines in small constant and variable delivery pumps, and axial piston motors are shown along with improved standard and heavy duty cylinders for pressures up to 3000 psi. Valves for controlling the cylinders are listed. The Oilgear Co.

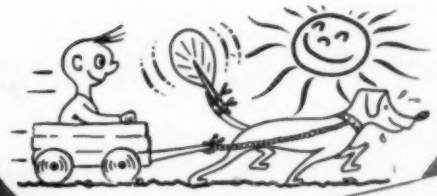
244—Micarta Gears. An introduction to micarta gearing is provided in 15-page booklet that offers micarta gear manufacturing know-how. Machining, designing and application information is given along with illustrated explanations. Lists physical properties, preferred pitch and gear data for full depth teeth, in addition to illustrated examples of micarta-gear hp-rating formulas. Also listed are 57 applications of the gears. Westinghouse Electric Corp.

245—Uni-Pull Drive Manual. This 40-page book enables you to select without any calculation, the proper size flat leather belt together with pulleys of the correct dimension, to transmit power from a motor of given hp and speed to a machine to be operated at a prescribed speed. Includes tables from which belt tension controlling motor base can be selected for motors built in standard NEMA frames. Also contains basic hp rating data for flat leather belting, recommended minimum pulley diameters and other pertinent drive information. American Leather Belting Association.

PUMPS AND ACCESSORIES

246—Screw & Rotex Pumps. Warren's acquisition of the Quimby Pump Div. has, among other things, produced two bulletins illustrating and describing the latest refinements in screw and Rotex pumps. Screw pumps are available in capacities up to 3000 gpm and pressures up to 200 psi, while Rotex pumps have capacities up to 100 gpm and pressures up to 250 psi. Warren Steam Pump Co., Inc.

(Continued on page 130)



What Other Drive Gives You...

1. BY-PRODUCT POWER

Power to drive pumps, blowers or stokers...auxiliary electrical supply for special needs...off-peak or standby generating capacity—these can be obtained almost free by utilizing the By-Product Power available through Troy Steam Engines.

Steam used for heating or processing packs plenty of horse power as well as B.T.U.s. Under the right conditions, Troy Steam Engines can extract this latent power while actually improving the heat balance. By-Product Power can be converted into A.C. or D.C. electricity by efficient Troy Generating Sets, or it can be utilized directly to drive stokers, fans, pumps, blowers, kilns, compressors, mixers and similar equipment. With the Type EN Governor, constant speed can be maintained accurately; or speed can be automatically varied over an exceptionally wide range.

Double duty: Steam drives high pressure pumps and provides heat for processing in this installation of multiple Troy Steam Engines in the Port Arthur refinery of The Texas Company.

Plus-

2 HIGH STARTING TORQUE

3 UTMOST FLEXIBILITY

4 SIMPLICITY, LONG LIFE

5 ACCURATE, FAST SPEED CONTROL

Which Do *You* Need?

If your drive needs any or all of these five characteristics, the *modern* Troy Steam Engine is indicated. Send us your drive requirements and steam conditions, and our engineers will be glad to recommend the right type and size Troy engine to meet your needs.

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Troy Engine & Machine Co.

Power Equipment Division

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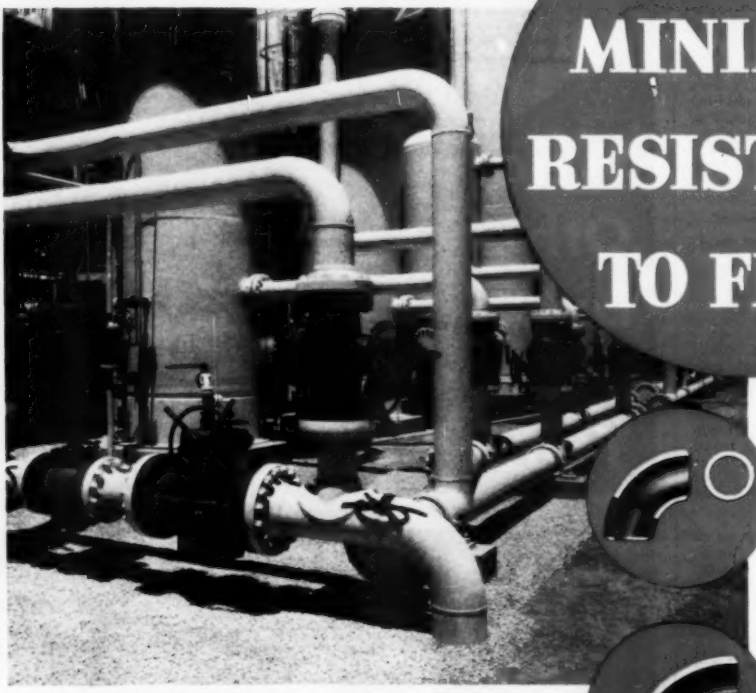
Grinnell Welding Fittings for

MINIMUM RESISTANCE TO FLOW



Grinnell Welding Fittings on towers of natural gasoline plant.

TRUE CIRCULAR SECTION

True circular section at all points makes a Grinnell fitting easy to align and weld . . . no distortion or flattening to affect flow adversely.

FULL EFFECTIVE RADIUS

Pressure loss through Grinnell welding elbows is held to a minimum because of the full, effective sweep of the radius.

SMOOTH, CLEAN INSIDE SURFACE

Grinnell fittings have uniformly smooth inner walls . . . no waves or ridges to cause turbulence or accelerate erosion or corrosion. No pockets to trap solids or foreign matter.

EASY, SWEEPING TURNS

In Grinnell welding tees, the corners where the outlet joins the run are well-rounded and perfectly smooth to minimize resistance to flow and to prevent trapping.

Any qualified welder can make welds quickly and easily with Grinnell welding fittings. These fittings are made by a hydraulic forging process that assures uniform wall thickness at all points and true circularity throughout. Of seamless, one-piece construction, they can be cut at any angle to match up with standard weight, extra strong and heavier wall pipe in I. D. or O. D. sizes. Pressure-temperature ratings are equal to or greater than those of seamless steel pipe. Grinnell welding fittings are process stress-relieved.

Full data on the complete line of Grinnell carbon steel butt welding fittings and forged steel flanges is contained in the Grinnell Welding Fittings Catalog.

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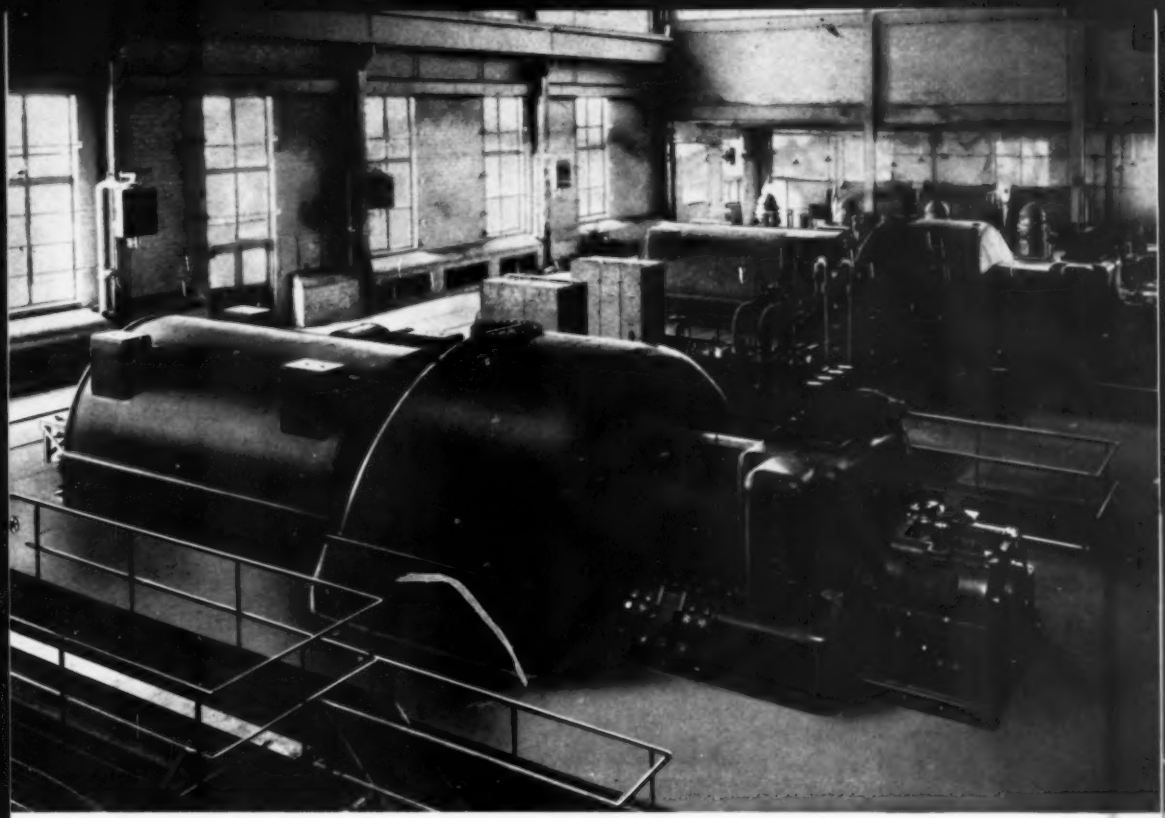

Over 250,000-KW Capacity Operating on . . .

NONPAREIL
TRADE MARK
Turbine Oil

● With the installation of a 45,000-KW turbine shown in the foreground of the illustration above, a large midwest utility now has six large turbines – over 250,000-KW capacity – operating on NONPAREIL Turbine Oil.

There is reason to believe that this new turbine will never have to be shut down for oil replacement, oil-system cleaning, or because of oil-acidity troubles. This conviction is based on the lubrication record of NONPAREIL Turbine Oil in this plant.

During *ten years of operation*, neutralization numbers have stayed below .07 mg. KOH/gm. There have been no time losses or troubles caused by high acidity. Oil systems have stayed clean. Such benefits are assured this company, not only for 10 years, but for the *life* of its turbines. This assurance is based on NONPAREIL's written guarantee that it will maintain a neutralization number below 0.15 mg. KOH/gm.

WITH NO OIL-ACIDITY OR OIL-REPLACEMENT WORRIES

Why not end oil-system maintenance and oil-acidity troubles once and for all, by using NONPAREIL Turbine Oil in your turbines? For more evidence of these savings, ask a Standard Oil Lubrication Engineer to supply you data from 23-year service records of NONPAREIL Turbine Oil.

• • •

Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD OIL COMPANY (INDIANA)

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NOW more important than ever to you

You are, or may soon be, shifting your production setup to meet the country's rearmament needs. New machines, new operations, and faster production schedules will demand some revision of your lubrication practices. That's why Standard's Service-Supply organization is now more important than ever to you.

Standard has a service-supply warehouse within a short truck-hauling distance from your plant.

If you are a Standard Oil customer this warehouse will stock every lubricant used in your plant. Deliveries can be made in a few hours if necessary.

In addition, this service-supply center is headquarters for a Standard Oil lubrication specialist who is assigned to your plant. He is close at hand to give you help when you need it. He has plenty of practical experience. He has been specially trained for his job in a Standard Oil Lubrication Engineering School. He is backed by Standard Oil's extensive research and technical facilities.

To arrange for his visit, phone your nearby Standard Oil Service-Supply center or write to: Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

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STANDARD OIL COMPANY (INDIANA)

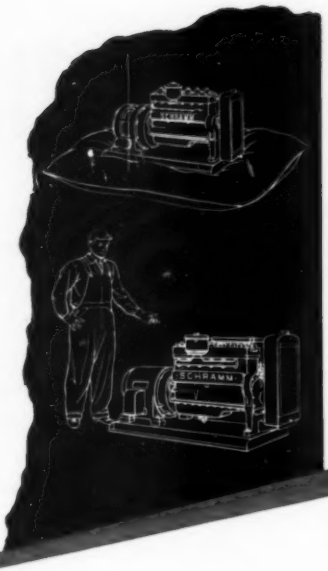
features

OF SCHRAMM AIR COMPRESSORS Mean Savings To You!

Many advantages are offered you by Schramm Air Compressors.

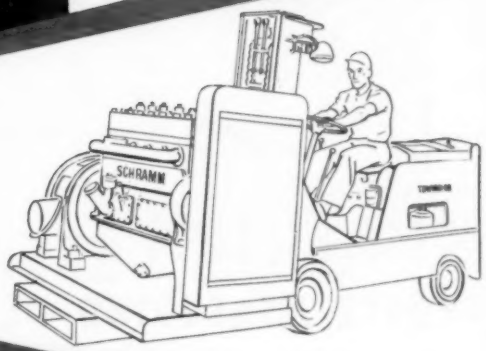
Vibrationless

Compact



EASY TO MOVE

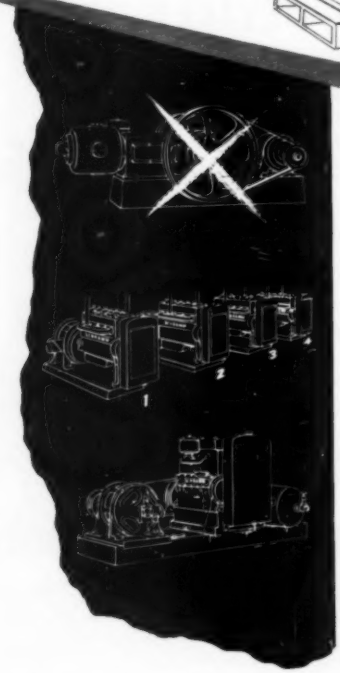
"Air when you want it"



One cost—
no elaborate
foundation

Unit system

Complete
package—
easy to install



One of the chief advantages of Schramm is its ease of moving. When your plant layout changes . . . or you need an air compressor in a different building . . . the quickest way to transfer and make installation is to use a Schramm. It is compact, easy to handle because compressor and motor are mounted as a single unit on a substantial steel base, which also serves as a foundation.

For your many compressed air jobs about the plant, specify Schramm—and save. Write today for folder STF-50.

SCHRAMM INC.

The Compressor People

WEST CHESTER • PENNSYLVANIA

WHAT PRICE PERFECTION!

"PERFECTION" is the most important word in the entire English language to a group of men at John Chatillon & Sons.

These researchers, engineers and planners are constantly working toward the improvement of measuring apparatus that already connotes perfection to every user

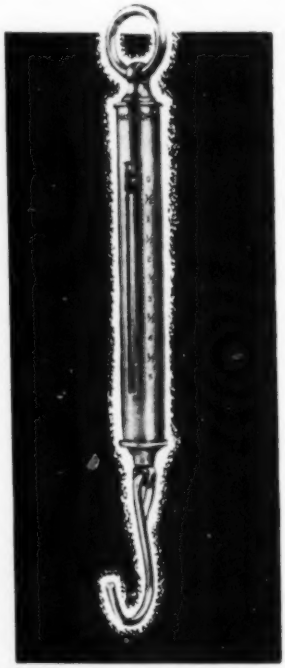
For example: These Force Measuring Devices, which are the finest available, are individually calibrated and guaranteed to be accurate within one graduation mark on the gauge. This exactness is universally accepted, inasmuch as such devices simply are not expected to be more accurate. But — to John Chatillon & Sons, it represents a challenge—and full time research is constantly going on, until "Perfection"—complete and ultimate, is achieved.

"Resting on Laurels" is an invalid phrase at Chatillon.

CHATILLON SPECIAL FORCE MEASURING DEVICES

Only one fine Chatillon Device from Our Complete Line

- For adjusting Spring Tension of D.C. Motor Brush Holder
- For use with Torque Measuring Devices
- For Measuring Force in All Phases of Industrial & Laboratory Work



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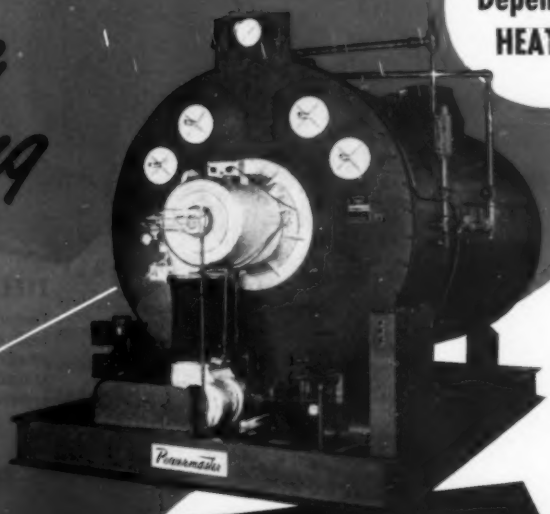
Reduce Operating Costs!

For Dependable HEATING

For Efficient PROCESSING



O & S *Powermaster*

● 15 to 500 H.P. steam generating units from 15 to 200 p.s.i. and hot water boiler units—for light oil, heavy oil, gas and combination gas/oil firing.

- Delivered completely wired and factory-tested
- Mounted on steel base — no bricking required
- Automatic operation frees engineer for other duties
- Constructed to A. S. M. E. standards
- Approved by Underwriters' Laboratories
- Prompt service by factory-trained men

● With your operating costs growing higher than ever, isn't this a mighty good time to take a look at your boiler room? That's where efficient, cost-saving plant operation should start.

Maybe your boiler is eating fuel dollars. Perhaps it's inadequate to meet your greater steam demands. Chances are it's obsolete at today's standards. You may find it possible to cut costs enough to actually pay for a new O&S *Powermaster* unit in two or three years. Many *Powermaster* users tell us they *have!*

It makes sense to turn to this up-to-date self-contained unit to produce the steam or hot water you need. All Powermaster components are sized to coordinate most efficiently as a fully automatic packaged unit. You'll reduce operating costs (as much as 40%) and cut maintenance time to a minimum. You'll be sure of safe, smokefree, dependable operation.

Write today for complete information on a Powermaster unit for your specific needs. Or send coupon for latest bulletin describing all units.

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STEAM GENERATORS AND HOT WATER BOILER UNITS

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Please mail latest catalog showing Powermaster's cost-cutting advantages.

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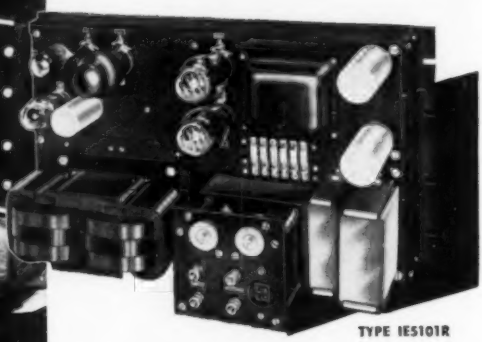
TYPE EM4115

TYPE EM (Electromechanical)

Features zero waveform distortion, high efficiency, insensitivity to magnitude and power factor of load, no critical adjustments. Has no effect on system power factor.

STABILINE
VOLTAGE REGULATORS



TYPE IE5101R

TYPE IE (Instantaneous Electronic)

Completely electronic, instantaneous in action, with no moving parts. Output voltage held to ± .1% for line variations; to ± .15% for load changes.

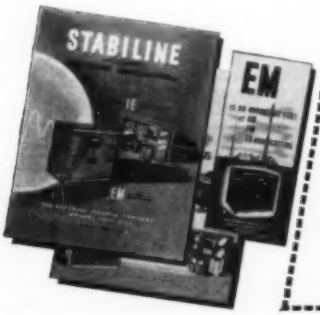
IN THE LABORATORY, *where constant voltage is a necessity for product development and analysis, STABILINE voltage regulators assure maximum performance of electrical instruments.*

TESTING *requires constant voltage to assure that products manufactured for specific applications will perform as rated. STABILINE voltage regulators guarantee exacting test results.*

PRODUCTION *is on the increase, equipment is working overtime. STABILINE voltage regulators are required to get the maximum from operating equipment, to give full life to motors and lighting, to lengthen tool life, and to cut maintenance and replacement costs.*

MAINTAIN CONSTANT VOLTAGE
...regardless of line or load changes

STABILINE Automatic Voltage Regulators deliver a constant output voltage regardless of variations in input voltage or load current. This control is vital to laboratories, production, testing and inspection — all departments where precision performance is demanded. Two basic types of STABILINES are available. Type IE (Instantaneous Electronic) is completely electronic, instantaneous in action, with no moving parts. Waveform distortion does not exceed 3%. Output voltage is held to within ± 0.1 of 1% for wide line variations; to within ±0.15 of 1% for any load current change or power factor change from lagging .5 to leading .9. Type EM (Electromechanical) consists of an electronic detector circuit controlling a motor-driven POWERSTAT variable transformer which feeds a buck-boost auxiliary transformer. Inherent characteristics include zero waveform distortion, insensitivity to magnitude and power factor of load, adjustable output voltage, no effect on system power factor and no critical adjustments. Both types are offered in numerous models and ratings. There's a STABILINE for every application. Technical data and bulletins sent on request. Use coupon below.



THE SUPERIOR ELECTRIC CO.
BRISTOL, CONNECTICUT

SECO

THE SUPERIOR ELECTRIC CO., 1503 CHURCH STREET, BRISTOL, CONNECTICUT

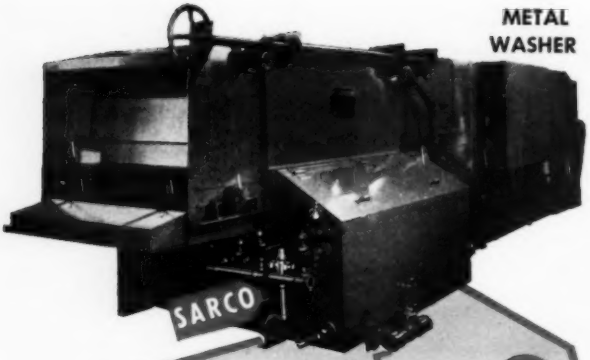
- ☐ Please send me Bulletin S351 on STABILINE Automatic Voltage Regulators.
- ☐ Keep me on your mailing list.
- ☐ Have a SECO field engineer call.

My Name _____

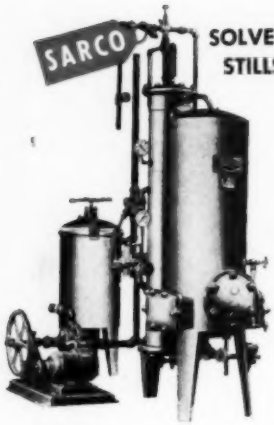
Company Name _____

Company Address _____

City _____ Zone ____ State _____



METAL WASHER



SOLVENT STILLS

A MARK OF DISTINCTION

When you buy steam equipment

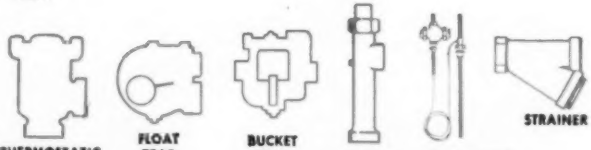
Equipment on which
SARCO
is standard

WATER HEATERS
•
BOTTLE WASHERS
•
CAP SEALERS
•
DEGREASERS
•
AIR CONDITIONERS
•
SOLVENT STILLS
•
AIR COMPRESSORS
•
OVENS & BOILERS
•
LAUNDRY MACHINERY

Why is it that more than 100 manufacturers of steam operated machinery prefer to equip with Sarco steam traps, temperature controls or strainers before the equipment is shipped? The answer is simple. After years of tests in their plants and in the field they know that their machines will produce more with less steam and fewer service calls.

Isn't that exactly what you want from *all* the steam equipment installed in your plant? If so, all you have to do is to insist on "Sarco Equipped" when you buy new machinery or modernize your present equipment.

A few of the Sarco products supplied with new equipment are illustrated below. For complete information write for Catalog No. 200.



THERMOSTATIC TRAP | FLOAT TRAP | BUCKET TRAP | LIQUID EXPANSION TRAP | TEMPERATURE REGULATOR | STRAINER

317

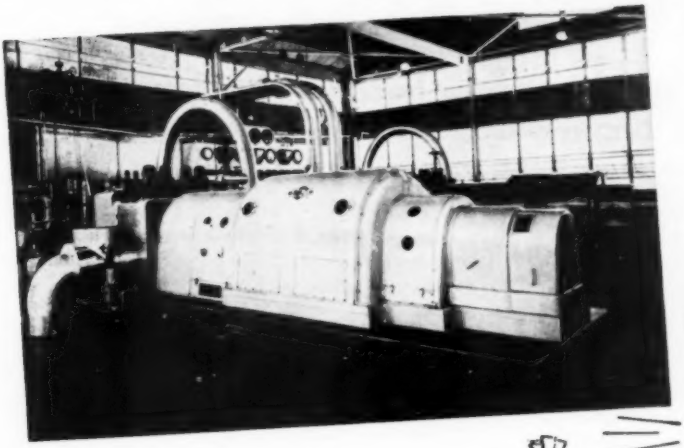
SARCO COMPANY, INC.
Represented in Principal Cities
Empire State Building, New York 1, N. Y.
SARCO CANADA, LTD., TORONTO 5, ONTARIO

SARCO SAVES STEAM

IMPROVES PRODUCT QUALITY AND OUTPUT

HANDLING TWO JOBS AT ONCE...

and saving money on both!



Two 1500 KW Worthington turbine-generators, installed in the Eunice, N. M. plant of the El Paso Natural Gas Company. These are non-condensing extraction turbines designed to operate on initial steam conditions of 575# — 575° FTT exhausting at 5#G back pressure.

Worthington Turbine-Generators Selected By Natural Gas Firm For Both Power and Product-Conditioning

Pumping natural gas from southeastern New Mexico and the Texas Panhandle to points in California and Arizona, the El Paso Natural Gas Company uses Worthington Turbine-Generators for double duty. Besides furnishing electricity for the company's plant in Eunice, N. M., the turbines automatically extract steam at 125#G for heating Amine solution, which is mixed with the gas to remove impurities.

In every branch of industry, users are getting daily proof of the outstanding flexibility of Worthington Turbine-Generator Sets — not only as sources of more dependable, more economical electric power, but as cost-cutting suppliers of processing steam for many important allied purposes.

WORTHINGTON TAKES ALL THE RESPONSIBILITY

Worthington builds Turbine-Generator Sets in sizes up to 10,000 kw, and in all types. Each is designed to make steam do more work, and each is backed by Worthington's undivided responsibility for the complete unit's design, assembly and performance. For expert aid in selecting the *right* size and type for your own requirements . . and further proof that *there's more worth in Worthington* . . call our nearest District Office. Or write to *Worthington Pump and Machinery Corporation, Steam Turbine Division, Wellsville, N. Y.*

WORTHINGTON

STEAM TURBINES

T.O.S

A GREAT TEAM IN STEAM

Feed Water Heaters | Multi-Stage Turbines | Boiler Feed Pumps | Turbine-Generator Sets | Single-Stage Turbines | Surface Condensers

"S" MONEL

A casting alloy offering extra hardness at elevated temperatures, pronounced resistance to galling and seizing, and excellent corrosion resistance.

One of the hardest and strongest of the non-ferrous casting alloys, "S"® Monel is particularly suitable for parts subject to high stress and severe friction under corrosive conditions.

"S" Monel's low coefficient of expansion, high density and corrosion resistance enable it to give excellent service where clearances are small and operating temperatures subject to considerable variation.

The principal characteristics of "S" Monel are:

• • •

Typical Applications of "S" Monel

valve discs	bushings
valve seats	sleeves
impellers	ejector nozzles
wear rings	direct-acting pump liners

Mechanical Properties of "S" Monel*

(Age-hardened)

Yield Point	80-115,000 psi
Tensile Strength	120-145,000 psi
Elongation in 2-in.	4-1%
Hardness (Brinell)	300-375
Coefficient of Thermal Expansion (32°-212°F.) in. in/°F.	.0000068

Hardness of "S" Monel at Elevated Temperatures*

(As-cast condition)

Temperature, °F.	Brinell Hardness
Room	321
700	321
800	311
900	311
1000	321
1050	335
1100	293

*Average properties—not to be used for specification.

Hardness: "S" Monel can be age-hardened to 300-375 Brinell. It retains this hardness even at elevated temperatures. (See table.)

Resistance to Galling: "S" Monel is superior to most other hard metals in its ability to resist galling under severe conditions of pressure and friction. Often where lubrication is poor or absent entirely, "S" Monel has shown unusual resistance to seizing.

Corrosion Resistance: "S" Monel is relatively unaffected by most commonly-encountered corrosives . . . reducing acids, organic acids, acid and neutral salt solutions, strong alkalies, dry gases, and most atmospheres.

Erosion Resistance: Because of high hardness and toughness, "S" Monel resists damage caused by cavitation, erosion, "wire drawing," and particle abrasion.

Machinability: "S" Monel can be machined as-cast, and preferably so when only a moderate amount of machining is to be done. For extensive machining, the castings may be softened to 235 Brinell by heat treatment. Subsequent heat treatments can restore hardness to the level of 300-375 Brinell.

Weldability: "S" Monel is *not* recommended as a weldable material.

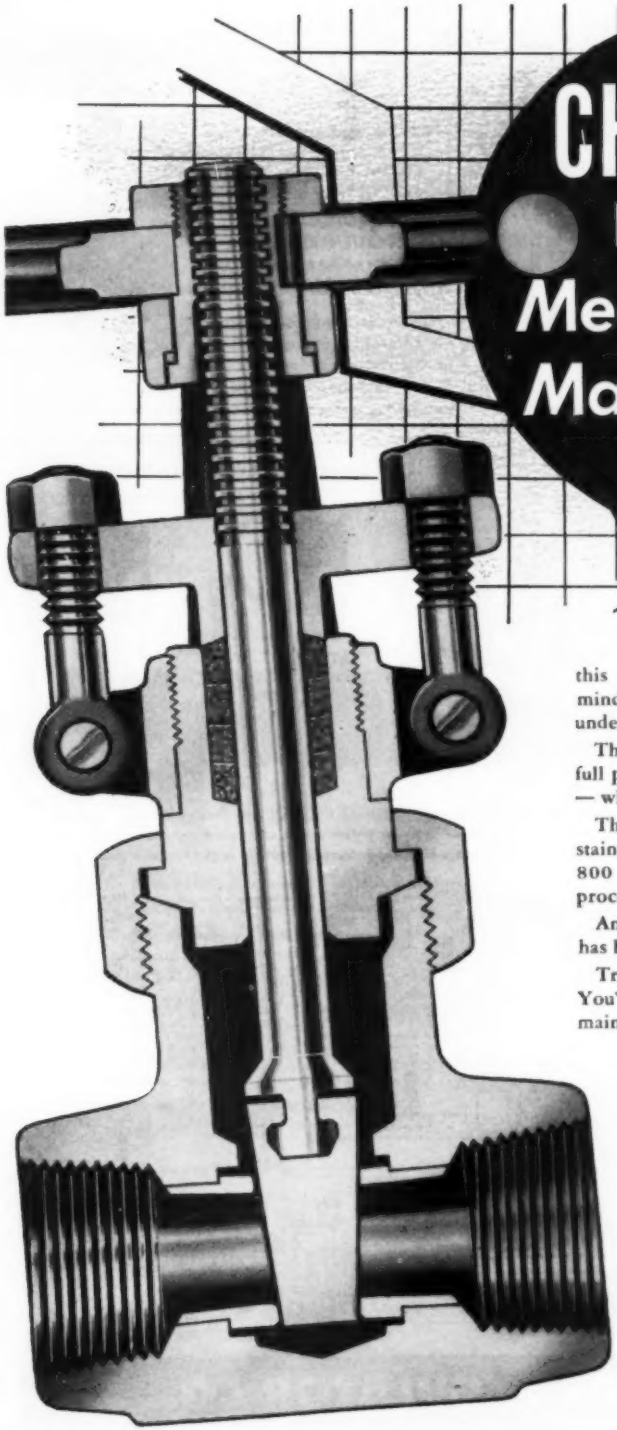
Additional Engineering Data Available

Although nickel alloys are currently in short supply, they won't always be. So why not let INCO *help you in your long-range planning — particularly if your plans involve a choice of corrosion-resisting materials? A letter outlining your problems brings technical assistance, helpful data. Write* INCO'S *Technical Service Station.*

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York 5, N. Y.

EMBLEM OF SERVICE
NICKEL INCO ALLOYS

MONEL® • "R"® MONEL • "K"® MONEL • "KR"® MONEL • "S"® MONEL
NICKEL • LOW CARBON NICKEL • DURANICKEL®
INCONEL® • INCONEL "X"®



CHAPMAN
LIST 960
Means Lower Maintenance Costs

Chapman engineers designed this valve with your maintenance problem in mind. They've made it *tough*, so it will stand up under severest service — but *easy* to maintain.

That's why you can repack this List 960 under full pressure. Seat rings replaced quickly, easily — when necessary.

The reason, too, why seat rings are hardened stainless steel and wedge faces are hardened to 800 Brinell by the exclusive Malcomizing process.

And why the stem and wedge gate connection has been made 50% stronger than ever before.

Try it! Make your own maintenance checks. You'll find the Chapman List 960 means lower maintenance costs.

Available in sizes from ¼" to 2". Either metal to metal or gasketed joint, as required. Rising stem with yoke (as illustrated) or rising stem inside screw type. For pressure range 2000 lbs. at 100 deg. F., 380 lbs. at 1000 deg. F. Specify List 990 for higher pressures.

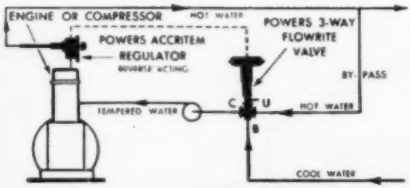
The Chapman Valve Manufacturing Company

INDIAN ORCHARD, MASSACHUSETTS

Before You Buy

JACKET WATER TEMPERATURE CONTROL

Investigate



One of Many Applications of POWERS ACCRITEM REGULATOR and FLOWRITE DIAPHRAGM VALVE— Compressed Air or Water Operated

—Provides positive, dependable control for large size 3-way or 2-way valves. ***Safety feature*** of hook-up above: failure of air or water pressure allows only cooling water to flow through the valve to engine.

POWERS

Complete Line of Dependable, Time-Tested Regulators

IMPORTANT ADVANTAGES that quickly pay back the cost of Powers self-operating and pneumatic controls for air compressors, diesel and gas engines:

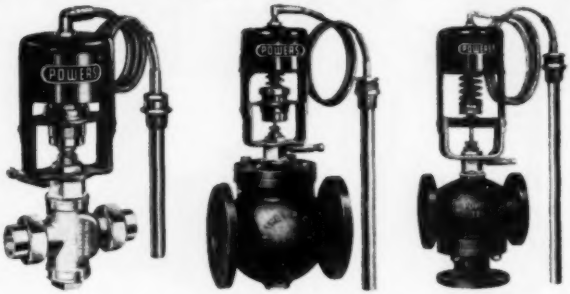
- **Correct jacket water and lube oil temperature at all times, regardless of load or seasonal changes.**
- **Improved lubrication and cylinder liner wear.**
- **Fewer piston ring replacements.**
- **Saves Labor; increases efficiency.**
- **Reduces danger of piston seizure.**
- **Eliminates sludging.**
- **Lowers fuel and lube oil consumption.**

Cost of Powers jacket water temperature control? About the same as a set of new piston rings. Powers regulators are unsurpassed for reliability and years of trouble free service.

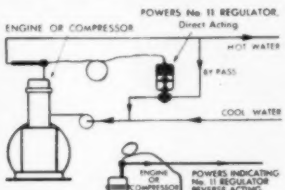
Have a POWERS Engineer call to study your requirements for better jacket water temperature control. There's no obligation. Phone or write our nearest office.

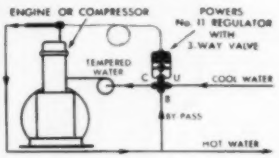
CHICAGO 14, ILLINOIS • 2720 Greenview Avenue
NEW YORK 17, NEW YORK • 231 East 46th Street
LOS ANGELES 5, CALIF. • 1808 West 8th Street
TORONTO, ONTARIO • 195 Spadina Avenue
MEXICO, D. F. • Edificio "La National" 601
(DIG)

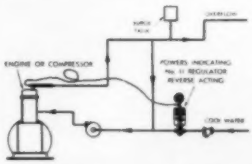
No. 11 Self-Operating TEMPERATURE REGULATORS

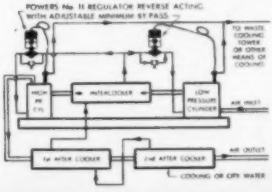


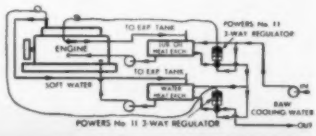
Provide dependable control for most applications. They're simple, ruggedly built, economical and easy to install. Especially suited for air compressors, diesel and gas engines. Temperature indicating regulator also available.








POWERS No. 11 REGULATOR REVERSE ACTING WITH ADJUSTABLE MINIMUM BY-PASS
TO WASTE COOLING TOWER OR OTHER MEANS OF COOLING
INTERCOOLER
LOW PRESSURE CYLINDER
AIR INLET
1st AFTER COOLER
2nd AFTER COOLER
AIR OUTLET
COOLING OR CITY WATER

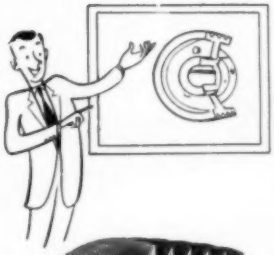


Established 1891

THE POWERS REGULATOR CO.

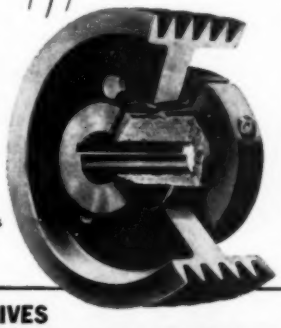
OFFICES IN OVER 50 CITIES

Don't buy a V-Belt Drive unless—



1. the sheave comes in two parts for easy mounting—separately or as one-piece assembly[a]
2. the hub and rim are "taper-mated", for friction cone grip and positive press fit on shaft[b]
3. the clamped hub holds shaft position when rim size is changed—no realignment problem[a]
4. I-beam spokes on driven sheave help carry heavier load with less weight[a]
5. the belt carries the load with minimum internal friction[c]

a Worthington exclusive
b Worthington original
c Worthington-Goodyear original—endless load-carrying cords in neutral axis



WORTHINGTON MULTI-V-DRIVES

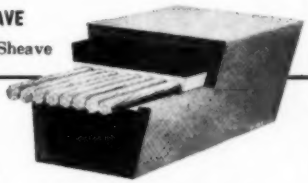
Easy to get on

Easy to get off

Yet always tight on the shaft

WORTHINGTON QD SHEAVE

Original Tapered Cone-Grip Sheave



WORTHINGTON-GOODYEAR EC CORD V-BELTS

Each endless cord carries an equal share of the belt load—each belt, matched and uniform in length, carries an equal share of the drive load.

Send coupon for latest Worthington QD Sheave bulletin, V1400B7F

Complete Range of QD Stock Sizes— Prompt Shipment 853 listed stock sizes in "A", "B", "C", and "D" sections fhp to 600 hp . . . 332 listed stock sizes of EC Cord V-belts.

It was a crisis that occurs only on Saturday mornings

Minutes before noon on a Saturday morning, a frantic call to **Oberjuerge Rubber Distributing Co.**, St. Louis, Mo. reported a motor failure at a brickyard.

A week's stoppage of production was threatened.

A different motor was available, but not the right rpm.

Could Oberjuerge furnish belts and sheaves to give the proper speed? Answer (after some quick calculations): yes—two Worthington QD Sheaves, 8 groove, 16 in. driver, 58 in. driven, with a set of 8 Worthington-Goodyear V-Belts.

By mid-afternoon, the brickyard was back in production. Again, a Worthington distributor had saved the day—or, in this case, a week!

WORTHINGTON

ORIGINATORS OF THE QD SHEAVE
WORTHINGTON PUMP AND MACHINERY CORPORATION
MULTI-V-DRIVE SALES DIVISION
Buffalo, N. Y. · General Offices: Harrison, N. J.

POWER TRANSMISSION: sheaves, V-belts, variable speed drives
PUMPS: centrifugal, power, rotary, steam
AIR COMPRESSORS: water-cooled, air-cooled

The Good Right Hand of Industry

Worthington Pump and Machinery Corp.
Multi-V-Drive Sales Division,
Buffalo, New York

Send Bulletin V1400B7F on Worthington Multi-V-Drives.

Name .....
Company .....
Address .....
City ..... Zone .... State .....

...and CONSERVE *precious Brass and Copper*

"ECONOMY DE-LAY" Renewable Fuses offer you the opportunity to conserve scarce Brass and Copper and at the same time make a real saving in the cost of your Fuse maintenance.

After your first cost of an "ECONOMY DE-LAY" Renewable Fuse, you pay only a few pennies for an "ECONOMY DE-LAY" Renewal Link to restore the Fuse to its original efficiency after a "blow". This is much cheaper in the long run than any other type of Fuse protection you can buy.

The simplicity and unusually fine mechanical construction of "ECONOMY DE-LAY" Renewable Fuses and Renewal Links make replacement quick, easy and inexpensive.

With a reputation for Pioneering and Constant Improvement, ECONOMY has always made its Renewable Fuses and Renewal Fuse Links to meet the maximum of all requirements of "The Standard for Fuses".

Millions of ECONOMY Renewable Fuses have been in service for years, giving low-cost protection to electrical installations. Keep a full stock of "ECONOMY DE-LAY" Renewable Fuses and Renewal Links on hand!

Ask for the ECONOMY Catalog and Price List.

ECONOMY DE-LAY RENEWABLE CARTRIDGE FUSES

Copyright Reg. U. S. Pat. Office

Your Electrical Wholesaler has "ECONOMY DE-LAY" Renewable Fuses and Renewal Links in stock.

ECONOMY FUSE AND MFG. CO., 2717 GREENVIEW AVE., CHICAGO 14, ILLINOIS REPRESENTATIVES IN ALL PRINCIPAL CITIES

5841

This close-up clearly shows the ribs or corrugations which add strength to Childers Jacketing and also make it form more easily around lines. Aluminum strapping and seals are a quick, inexpensive way to attach the jacketing. They can be used without any special tools and take no special training for the installers.

Does long lasting aluminum cost too much for covering your insulated lines? Not when you specify this new type weather-proof jacketing. It has been specially developed to cost little more than ordinary temporary jacketing materials.

New Low-Cost Jacketing Cuts Maintenance on Insulated Lines

AT LAST an aluminum jacket has been "engineered" especially to protect outdoor lines in refineries and chemical plants. It is the first "permanent-type" jacketing that offers both low initial cost and low application cost.

After two years of tests and major installations at 431 outdoor locations in power plants, refineries, and chemical plants, the Childers Manufacturing Co. of Houston has rung up an impressive cost-cutting record with their Childers Aluminum Jacketing.

Secret behind this low cost is the thin aluminum sheet—.006" thick—which is the weather-protecting sheath of the jacketing. It is ribbed (as pictures show) for extra strength and to facilitate forming around the line. This aluminum has proved thick enough to resist weathering and usual abrasion, but costs much less than heavier aluminum sheets.

Easy application of this Childers Jacketing cuts labor bills drastically. It comes from the factory in easy-to-handle rolls that are four feet wide and either 100 feet or 200 feet long. It is light and flexible to handle as the men put it on the line. No roll forming required as with heavy, un-crimped material. It can be cut off and attached just the same as the old-fashioned tar-paper that was sometimes used for jacketing.

You can attach Childers Jacketing around your insulated lines by one of several easy methods. The use of aluminum strapping and seals is probably the best. Sheet metal screws or Minnesota Mining's No. 471 tape can also be used.

The Childers jacketing can be removed and re-used.

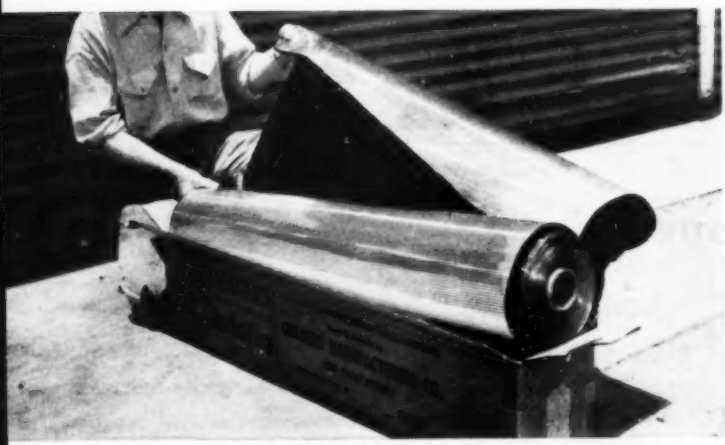
A moisture barrier is attached to the back of the jacketing to give positive protection for the aluminum when it is used with alkaline insulating materials.

No painting, no rust-proofing, little maintenance — that's the advantage of aluminum!

Hundreds of design engineers and maintenance engineers have agreed they save money for their firms and trouble for themselves by changing their jacketing specs to Childers 100%. That should make it worth your testing too—and a test roll costs only $40.00 for 400 sq. ft. (with moisture barrier attached—price for 800 sq. ft. without moisture barrier $62.00). That's a good investment in any plant. (Advt.)

* * *

FOR FULL INFORMATION write Childers Manufacturing Co., Dept. YP-1 625 Yale St., Houston 7, Tex., for complete literature. Childers has engineering representatives in principal cities to work with you on specific problems.



This is how Childers Aluminum Jacketing is shipped in easy-to-handle rolls. It is quite flexible, yet stands up under severe weathering.

LINDE Oxygen and PREST-O-LITE Acetylene in Handier Cylinders

LINDE Trade-Mark

PREST-O-LITE Trade-Mark

PORTABILITY PLUS!

convenient
lightweight
easy to use
easy to move

	Style	Capacity cu. ft.	Height in.	Diam. in.	Weight	
					Full lb.	Empty lb.
Oxygen	Q*	80	35	7⅛	67	60
Acetylene	WQ	60	24¾	7¾	55	51

* In some areas, Style XL, 70 cu. ft.

ORDER FROM YOUR

Linde Trade-Mark

DISTRIBUTOR

The terms "Linde" and "Prest-O-Lite" are registered trade-marks of Union Carbide and Carbon Corporation.

Ask your local LINDE distributor for details of new, money-saving oxygen and acetylene supply plan —or phone him for prompt service on a complete line of quality welding and cutting apparatus, rods, supplies, and accessories. Linde Air Products, a Division of Union Carbide and Carbon Corporation, 30 East 42nd Street, New York 17, N. Y.

When the Heat's on... Lubricate with "dag" Colloidal Graphite

AT 500° F., and virtually as far up as you ever go in metalworking operations, a **"dag"** colloidal graphite dispersion will overcome friction and keep parts lubricated for action. Even up to 5000° F. in inert atmospheres, this unusual lubricant resists the effects of heat.

"Dag" colloidal graphite is not just an ordinary lubricant. It is electric furnace graphite that has been specially processed to subdivide it into particles of microscopic size . . . small enough to pass readily through the pores of filter paper.

When colloidal graphite is applied to the friction surfaces of metal it leaves a graphoid film so thin that even the most sensitive gages cannot detect it. This lubricating film provides the metal with a surface that has an extremely low coefficient of friction, that resists oxidation, and that will function well above the burning point of oil.

The uses of **"dag"** colloidal graphite for all metalworking operations are explained fully in a new bulletin that is available without obligation. Write today to Acheson Colloids Corporation, Port Huron, Michigan, for your copy of Bulletin 426-17C

dag DISPERSIONS®

Acheson Colloids Corporation Port Huron, Mich.

...also Acheson Colloids Limited, London, England

It costs more to fix piping now!

No. 1613 Diaphragm Valve
Iron Body, Neoprene lined

You do less fixing

by using Dependable Quality

CRANE VALVES

. . . That's why more Crane Valves are used than any other make

better performing diaphragm valves

Separate disc and diaphragm design distinguishes these Crane Valves from all similar packless types. Life of diaphragm is multiplied because it's used only to seal the bonnet—not for seating. The separate disc seats the valve, eliminating wear and tear on the diaphragm.

Increased flow capacity . . . reduced flow resistance . . . tighter seating . . . lower torque and fewer turns to operate . . . are typical added features of Crane Diaphragm Valves. Wherever you use them, you can be sure of outstanding performance.

Such better quality and greater dependability mark Crane valves and fittings of every type—and assure the lowest ultimate cost.

CRANE

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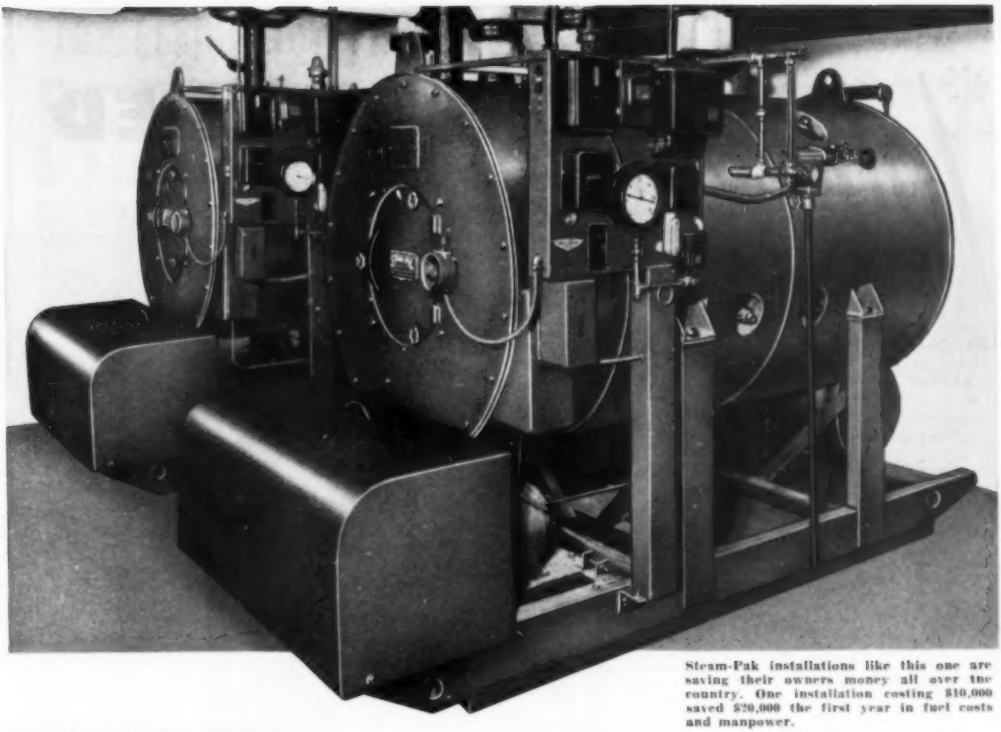
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING



Steam-Pak installations like this one are saving their owners money all over the country. One installation costing $10,000 saved $20,000 the first year in fuel costs and manpower.

STEAM-PAK YORK YS POWER GENERATOR
A PRODUCT OF YORK-SHIPLEY

WILL SAVE YOU MORE IN TIME & MONEY BECAUSE...

- Engineering design is recognized by top engineers and architects who specify Steam-Pak for quality and results.
- Satisfactory operation in thousands of buildings and plants all over the country prove Steam-Pak's ability to satisfy customers.
- Distributors chosen for their engineering ability, are trained to provide you with the best engineering "know-how" for installation and service of your equipment.

These are three basic reasons why Steam-Pak should be No. 1 on your list of steam generators. See your nearest York Power distributor, or write for complete details.

Steam-Pak Generators are built in capacities from 15 H.P. up, for low or high pressure, steam or hot water, for light or heavy oil, combination gas and oil, or straight gas.

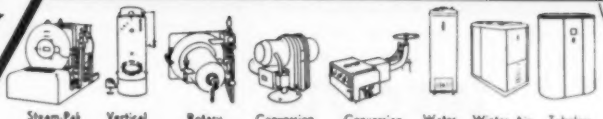
316 JESSOP PLACE · YORK, PENNSYLVANIA · PHONE 7861

YORK SHIPLEY

Industrial Division

INDUSTRIAL DIVISION YORK YS POWER

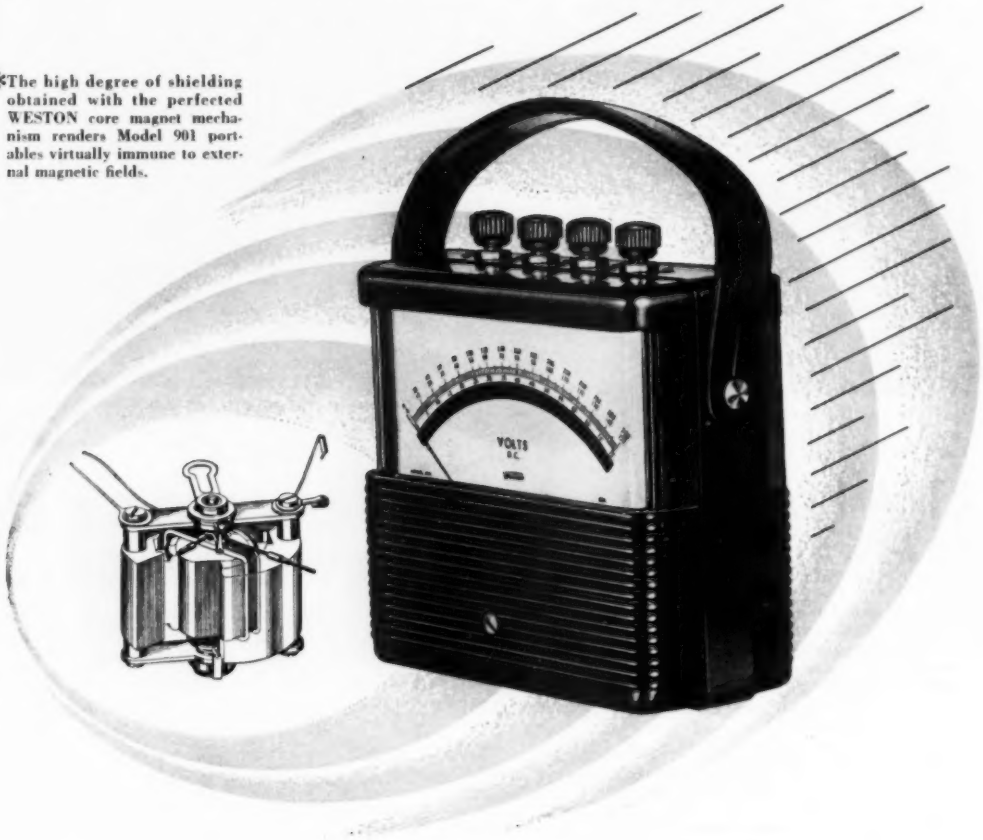
YORK HEAT RESIDENTIAL DIVISION



Steam-Pak Generators · Vertical Boilers · Rotary Oil Burners · Conversion Oil Burners · Conversion Gas Burners · Water Heaters · Winter Air Conditioners · Tubeless Boiler Units

*Inherently SHIELDED

*The high degree of shielding obtained with the perfected WESTON core magnet mechanism renders Model 901 portables virtually immune to external magnetic fields.



For years instrument engineers have tried to build the magnet inside the moving coil for a more compact, more stable, inherently shielded d-c mechanism. In the Model 901 d-c portable instruments, Weston provides a practical and proved design of this type. The Weston core magnet construction gives uniform flux field over a wide deflection angle . . . withstands extreme mechanical abuse . . . and is exceptionally well shielded without increase in size and with a reduction in weight. Be sure to get the details of this remarkable development from your local Weston Representative, or write Weston Electrical Instrument Corporation, 605 Frelinghuysen Avenue, Newark 5, New Jersey . . . manufacturers of Weston and Tagliabue instruments.

WESTON *Instruments*

TOP EFFICIENCY FROM LOW AND HIGH ASH COALS

PERFECT SPREAD STOKER

Three AE Perfect Spread 2-feeder, travelling grate Stokers recently installed by a leading pharmaceutical manufacturer in the midwest. The boilers, each with a maximum continuous capacity of 60,000 lbs. per hour are Union "A" Type. Efficiency at normal capacity, 83.4%; at maximum capacity, 82.4%. Consulting Engineer, Austin Company.

In the Boiler Room illustrated, the Perfect Spread Stokers were guaranteed to use coal containing either 13,306 B.T.U. or 11,327 B.T.U. per lb. as fired. These two coals have moisture contents of 4.7% and 10.7%, with ash content of 8.2% and 10.1%, respectively. With either coal, practically the same capacity is available but these Perfect Spread Stokers have done even better than predicted. Five different grades of coal have been used to date . . . and all with top efficiency.

Perfect Spread's unique feeder won't clog on wet coal but feeds uniformly—not in slugs—regardless of moisture content. Its engineered cinder return and adjustable overfire air system give comparable results from either low or high ash coals. Its even feed characteristic insures higher CO_2, freedom from smoke puffs, minimum carbon in the ashpit, and less fly ash. Feeders adjustable from 50 to 7,500 lbs. of coal per hour . . . capacities range from 8,000 to 500,000 lbs. of steam per hour. Mail coupon today for full data.

AE

AMERICAN ENGINEERING COMPANY

PHILADELPHIA 25, PENNA.

AE Products are: Taylor and Perfect Spread Stokers, Marine Deck Auxiliaries, Hele-Shaw and Hydramite Fluid Power, Lo-Hed Hoists, Lo-Hed Car Pullers

American Engineering Company
2406 Aramingo Ave., Philadelphia 25, Pa.

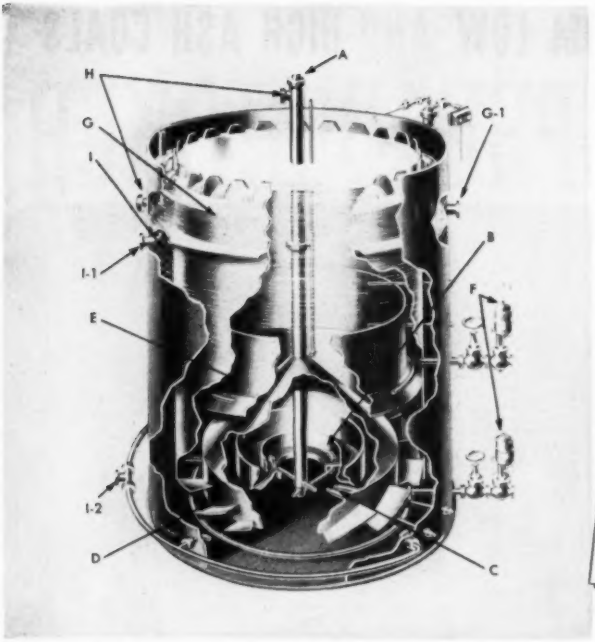
Gentlemen: We are interested in saving fuel dollars. Kindly send booklet giving full information about Perfect Spread Stokers.

Name ..... Title .....

Company .....

Address .....

City ..... Zone ..... State .....



Vortex mixing eliminates need for submerged moving parts in the Worthington Cold Process Slurry Type Precipitation Water Softener and Coagulator.

REACTION TANK of Worthington Slurry Type Softener (Slurry bed eliminated for clarity). (A) Raw water influent line. (B) Vortexor for optimum slurry production. (C) Chemical Applicators. (D) Slurry bed rotator. (E) Symmetrical Slurry concentrator. (F) Proportionate sludge removal. (G) Collector trough for treated water. (G-1) Treated water effluent. (H) Complementary recirculation. (I) Filter wash water compartment. (I-1) Filter wash water suction. (I-2) Filter wash water return.

This slurry bed stays put!

. . . and troublesome variables are out

These Features Give You The Uniformity You Want

WORTHINGTON SLURRY TYPE PRECIPITATING WATER SOFTENER AND COAGULATOR gives consistent, uniformly softened water

If it's clear, uniformly softened water you want, this unique Worthington Water Softener is just what you need. Concentrated quick mixing and rapid recirculation of applied chemicals and raw water, *achieved by hydraulic energy instead of submerged mechanical moving parts*, is an important, progressive development in the water treatment field.

New Bulletin W-212-B5 gives you 16 pages of vital facts about this unique cold process water softening method. Write for your free copy today.

REMEMBER . . .

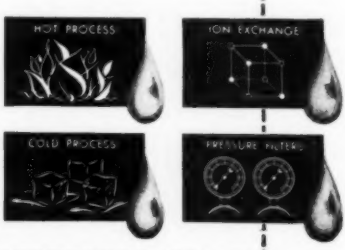
Worthington engineers *all four* water conditioning processes, therefore, can give you unbiased recommendations on which process is right for you . . . further proof that *there's more worth in Worthington. Worthington Pump and Machinery Corporation, Water Treating Division, Harrison, N. J.*

JO.1

WORTHINGTON

WATER CONDITIONING

Worthington Makes More of the Equipment for All Types of Water Conditioning Systems



All These Were Once
DUST COLLECTION PROBLEMS, TOO

48 Carbon Black Plants

203 Metallurgical Installations

205 Acid Plants

40 Paper Mills

270 Detarring Installations

216 Power Stations

73 Steel Plants

99 Oil Refineries and Miscellaneous Installations

Your electrical precipitator installation will be individually engineered...and based on the Research Corporation's *experience* graphically shown by that towering pile of thousands of blue prints.

This knowledge is a valuable asset that will help Research engineers to "tailor-make" your Cottrell installation. For example, they can more quickly determine the right answers to such variables as the size, shape and type of both discharge and collecting electrodes, their relative spacing, flue arrangements and many other factors. At Research you can count on *profitable solutions to individual problems.*

In hundreds of power plants today, Research Corporation Cottrells are collecting 90% to over 99% of fly ash from pulverized fuel boilers. Write for your free copy of an informative booklet giving valuable data on these installations. RC-116

Typical One Day Collections:

250 TONS OF FLY ASH • 6 TONS OF SODA SALTS AT A PAPER MILL • 25 TONS OF SODIUM SULPHATE AT A KRAFT MILL • 6 TONS OF BLAST FURNACE DUST

RESEARCH CORPORATION

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We're not out to corner the DAMPER MARKET...

. . . we want HEACON DAMPER applications that will pay for themselves in 6 months.

The Heacon Damper is not just *another* damper. It is designed and engineered to provide the tightest closure possible under all conditions. Each damper is developed to solve a specific problem, each provides the ultimate in control.

The dampers shown on this page all solved specific problems that could have been solved in no other way.

As an example, the second damper from the left above, not only controls 80" w.g. pressure, but also acts as an automatic reverse flow valve that instantly closes and prevents leakage should one of two fans on the boiler fail. The next damper on the right isolates its air heater for maintenance while the boiler continues in service. Such applications save many times their cost, in time and power loss.

Call or write the office nearest you for full details.

THE THERMIX CORPORATION
GREENWICH, CONN.

Canadian Affiliates: T. C. CHOWN, LTD.,
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416 Rhodes Building

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Parry Engineering Company
154 Nassau Street

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PITTSBURGH 19, PENNA.
Herr-Harris Company
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RICHMOND 1, VIRGINIA
Frank Hewell Company
Room 412, American Bldg.

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the adaptability of this BJ BILTON is more important now than ever!

SAVES SPACE

...close-coupled motor and pump are constructed in a single unit on a common shaft. No need for rigid foundation or base.

SIMPLIFIES INSTALLATION

...mounts in any position, at any angle, including wall mounting or sling mounting for portable use.

FEATURES INTERCHANGEABLE PARTS

...simplified construction uses fewer parts and allows easy interchangeability of all basic parts.

MINIMUM SPARE INVENTORY

...a small number of spare parts can serve a large number of working Biltons, providing full repair protection with a minimum inventory.

VERSATILE IN APPLICATION

...single-stage models meet all classes of low to medium head service. Two-stage models fill medium and medium-high head service.

The production problems to be met in the years ahead may demand a pump that can do more than one job ...a pump that can meet changing conditions of use...a pump that can be kept in service with a minimum of downtime. That's why now—more than ever—the adaptability of this Byron Jackson Bilton Pump has special importance to you. For more data on the Bilton or a BJ Job-Engineered Analysis of the model for your specific need, contact your local Byron Jackson sales office or write

AVAILABLE IN SPECIAL CONSTRUCTION

...BJ Mechanical Seal for handling liquids with special temperature, corrosion or pressure factors. Also explosion-proof motor, or other special construction.

Byron Jackson Co.

Since 1872

Dept. 61, P.O. Box 2017, Terminal Annex, Los Angeles 54, Calif.

OFFICES IN PRINCIPAL CITIES

LOW HORSEPOWER CONSUMPTION

...close-coupled construction allows more efficient application of power to pump.

BJ BACKS YOU UP with Nation-wide service and a dependable parts source

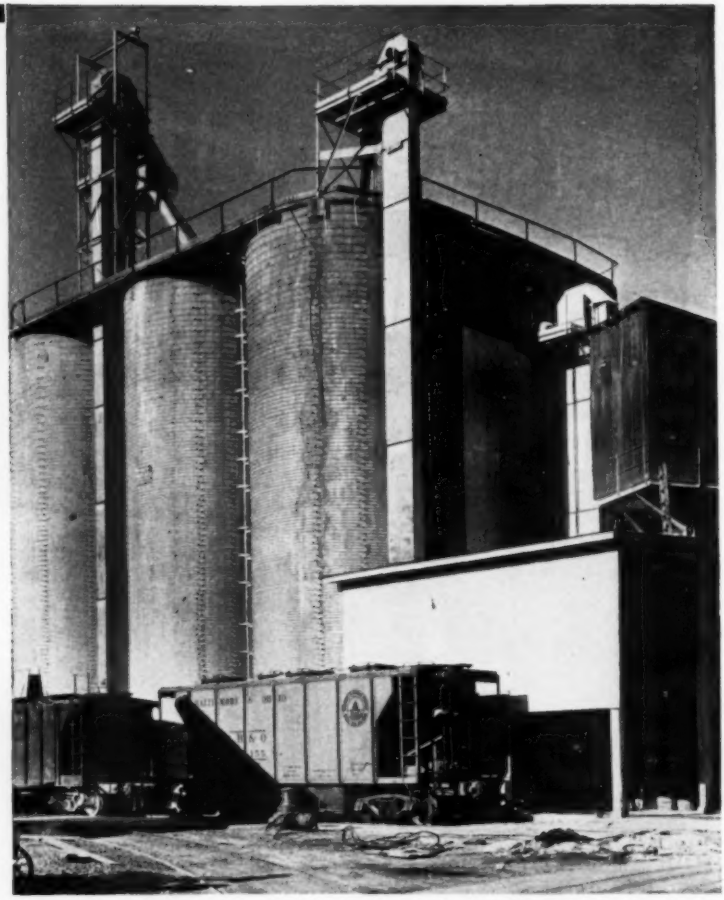
WIDE CAPACITY RANGE

...Single-stage models in 1¼, 1½, 2, 2½, 3, 4 and 5 inch sizes. Two-stage in 1½" size. Capacities to 2000 gpm, heads to 475 ft.

JEFFREY BUCKET ELEVATORS

New Improved Design

- Welded Angle Casings —heavy gauge steel Dust tight—Water tight
- Improved Head and Boot Sections
- Increased Bearing Protection
- Removable Hood
- Large Clean-out Doors both sides
- Large Inspection Doors for access to chain and buckets
- Take-ups furnished for Head or Boot if desired—self-aligning, plain or anti-friction bearings



Jeffrey Car Puller is shown in foreground.

These are only some of the features incorporated in our Standard Bucket Elevator line. A type and size to meet any requirement. Complete drawings available. Jeffrey Bucket Elevators are backed by years of engineering experience and hundreds of installations. May we hear from you?

Chains • Conveyors of all kinds • Feeders • Car Pullers • Bin Valves • Dryers and Coolers • Packers • Skip Hoists Screens • Crushers and Pulverizers Belt Idlers • Transmission Machinery Replacement Parts

THE JEFFREY MANUFACTURING COMPANY

Established 1877

814 North Fourth St., Columbus 16, Ohio

Complete Line of Material Handling, Processing and Mining Equipment

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The Galion Iron Works & Mfg. Co., Galion, Ohio
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NEW

SERIES 12100*

FORGED STEEL

DROP

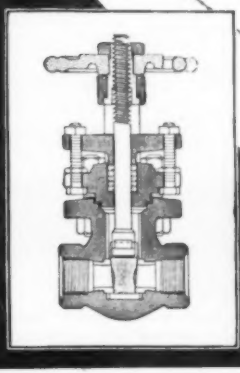
Vogt

BOLTED BONNET
BOLTED GLAND

150-800 POUND

GATE VALVES

SIZES ¼" to 2"



*Series 12100

CARBON } 800 Pounds @ 750° F.
STEEL } 1500 Pounds Cold Non-Shock

For 150-800 pounds service • Round Bolted Bonnet • Bolted Gland • Gasket or Ground Joint • Outside Screw and Yoke • Renewable Seat Rings • Solid Wedge — Slotted Type • Rising Stem 11½-13% Chrome Stainless Steel Trimmings • Sizes ¼" to 2" inclusive.

HENRY VOGT MACHINE CO. *Louisville 10, Ky.*

BRANCH OFFICES: NEW YORK • PHILADELPHIA • CLEVELAND • CHICAGO • ST. LOUIS • DALLAS

4 ways to know your combustion efficiency

The ever-increasing pressure for fuel economy makes some type of "combustion guide" instrument an essential part of any modern fuel burning operation. Hays offers the most complete line of such instruments in the industry—adaptable to your cost and engineering requirements. Your particular needs with regard to price, accuracy, speed of response, etc., will determine your choice—however, whatever your needs, Hays has the instrument.

Select your combustion guides *from the most complete line in the industry*

1

Measures fundamental indicator of combustion efficiency —Oxygen. Electronic in operation, with all of the most advanced features incorporated into its design, it is applicable not only to power plant conditions but also to a host of process problems such as catalytic crackers, open hearths, process heaters, inert gases, etc.

PRINCIPLE

Based on paramagnetic (attracted by magnetism) properties of oxygen. All other gases usually encountered are slightly diamagnetic (repelled by magnetism).

FEATURES

Highly sensitive to change in O_2 content
Rapid response to change in O_2 content
Electrically operated
Electronic type recorder
Temperature controlled
Pressure compensated
No liquid or gaseous fuel required to be added
No chemicals
High accuracy maintained
Not affected by wide change of gas flow rate
Continuous sampling and recording
Glass and corrosive resistant sampling system
Remote mounted analyzer
Remote mounted recorder
12" 24-hour chart
O_2 recorder and indicator
4 records on same chart possible
Low maintenance

2

Meter incorporates all of the construction and manufacturing ideas which Hays has developed during many years of experience in gas analysis. A deluxe instrument, the Condu-Therm CO_2 Analyzer is especially applicable to the larger boiler plants and to industrial processes.

PRINCIPLE

The principle of operation used in the Hays Condu-Therm Meter is that of thermal conductivity of gases, i.e., that all gases conduct heat at different rates.

FEATURES

Electrically operated
Electronic type recorder
Temperature controlled
Humidity controlled
No chemicals required
No moving parts in analyzer
Continuous sampling
No drying agent required
Easily installed glass and corrosion resisting sampling system
Not affected by wide change in gas flow rate
Rapid response
High sensitivity
Continuous recording
Remote mounted analyzer
Remote mounted recorder
12" 24-hour chart
CO_2 Recorder and Indicator
As many as 4 records on same chart
Low maintenance

3

Hundreds of these meters have been in operation for many years in all types of plants burning all kinds of fuels and saving thousands of fuel dollars.

PRINCIPLE

Operates on Orsat principle of Volumetric measurement and chemical absorption. Extremely simple: sample of flue gas trapped and accurately measured, passed through chemical which removes CO_2 component of gas mixture. Sample is re-measured, volume compared to original sample. Difference before and after absorption gives exact percentage of CO_2 absorbed by chemical.

FEATURES

Low price
Water operation
Pressure and temp. compensated
Volumetric determination
Chemical absorption
2 minute operating cycle
Easily understood
Rugged construction
Low maintenance
Available in 6 remote mounted types and 3 integral types
Remote or integral mounting
10" 24-hour chart
Available for: (a) CO_2 only—recording with or without indicator (b) CO_2 and flue gas temperature recorder combined (c) CO_2, draft or flue gas temperature recorder combined

4

Provides a QUANTITATIVE guide to efficiency — deals with quantities of air and steam; by contrast CO_2 and O_2 meters are QUALITATIVE guides since they determine directly quality of combustion gases. Both Boiler Efficiency Meter and Gas Analysis Meter are used to obtain advantages of both methods.

PRINCIPLE

Pounds of air required to burn each pound of coal vary widely with heating value of coal; constant weight of air is required to produce same Btu. Similar relationship exists when oil and natural gas are used as fuels. Record of steam flow is assumed to be Btu's produced; record of air flow is calibrated to flow of air required to generate that steam.

FEATURES

Electric operation of flow meter and air flow recorder
Diaphragm type air flow measuring unit
Air flow measuring element does no work
Air flow recorder—motor operated
Adjustable cam air flow calibration
Mercury transmitter—pressures to 2500 psi
Interchangeable range tubes for steam flow
Remote mounted steam flow transmitter
No high pressure piping into panel
Easily installed and adjusted
Low maintenance

THE **HAYS** CORPORATION
MICHIGAN CITY 2, INDIANA

Automatic Combustion Control • Boiler Panels • Hays-Penn Flowmeters
Veriflow Meters and Veritrol • Gas Analyzers • Draft Gages
Combustion Test Sets • CO_2 Recorders • Electronic Oxygen Recorders

In modern air-liners you breathe comfortably at altitudes of 25,000 ft., because your cabin is "Pressurized" — air pressure inside the plane is kept at or near normal sea level pressure.

Boilers, too, "breathe" easier when their combustion air is "pressurized" using forced draft

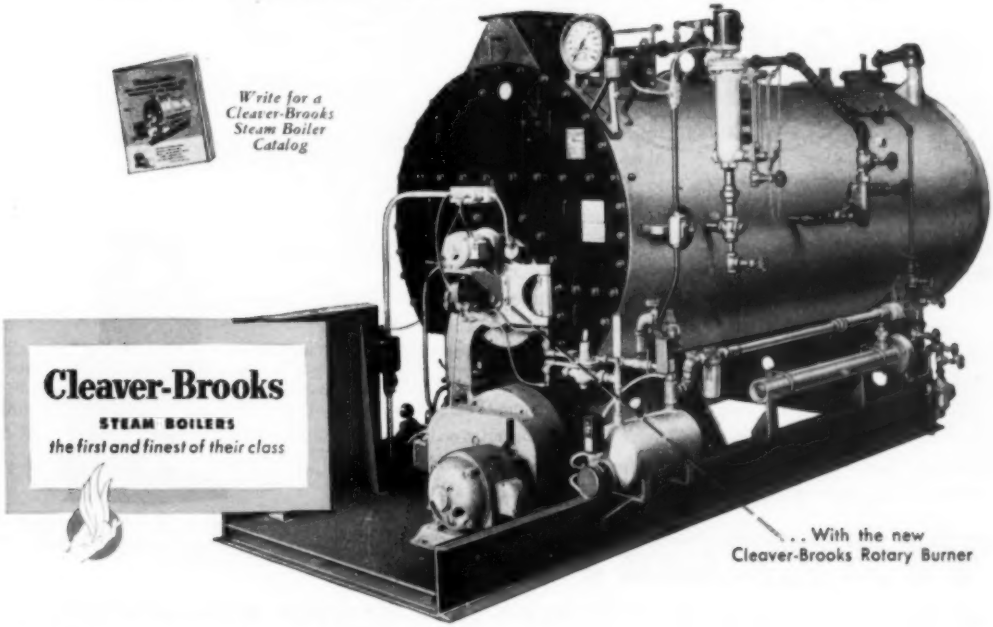
Cleaver-Brooks experience with thousands of steam boilers, of the self-contained type, has conclusively proven these operating advantages of forced draft:

- — because atmospheric boiler-room air is constant in temperature and therefore in density, the weight of air delivered for combustion by a forced draft fan is also constant and always gives proper air-fuel ratio (CO_2) resulting in maximum efficiency and freedom from combustion problems.
- — the electrical load, or power requirement, of a forced draft fan is at a minimum, because the fan handles a lesser volume of air.
- — low fan maintenance and longer fan life with forced draft fans since they operate with cool, clean boiler room air — no problems with high bearing temperatures and corrosion.
- — air is under pressure in the combustion chamber of a forced draft boiler, with no possibility of "diluting" air entering the chamber. Maximum boiler efficiencies are always attained when head plates and casings are tight.
- — lower initial fan cost, better space arrangement, and better appearance are gained because forced draft fans are considerably smaller.
- — casings for forced draft fans are cool — require no insulation — contribute to safer operation and cooler boiler rooms.

Forced draft is one of many reasons why you get a greater return from your investment in a Cleaver-Brooks boiler — a boiler of foremost quality in every detail and with many immediate and long-range cost-saving features. Cleaver-Brooks self-contained boilers are available for oil, gas, combination oil and gas firing — 15 to 500 hp., 15 to 250 lb. p.s.i.

CLEAVER-BROOKS COMPANY
335 E. Keefe Ave., Milwaukee 12, Wis.

Write for a Cleaver-Brooks Steam Boiler Catalog



. . . With the new Cleaver-Brooks Rotary Burner

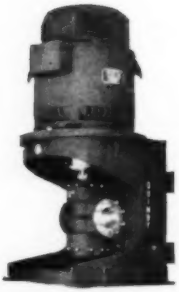
NOW *Quimby Pumps* WITH WARREN SERVICE

Now you can look to Warren for Screw and Rotary pumps as well as Centrifugal and Reciprocating types.

Quimby built the first balanced quadruplicate screw pump in 1893. The salient design feature of separate screws and timed driving gears have never been changed. However, refinements through the years have widened the scope of applications to include the handling of any non-abrasive liquid or semi-liquid at moderate and high pressures.

The "Rotex" is a superior rotary pump of unique construction that has numerous applications where moderate pressures are involved.

We are glad to add these new members to the Warren family and invite your inquiries on any problem involving Screw and Rotary, Centrifugal or Reciprocating Pumps.



Both Screw and Rotex type pumps are available either horizontal or vertical mounted.

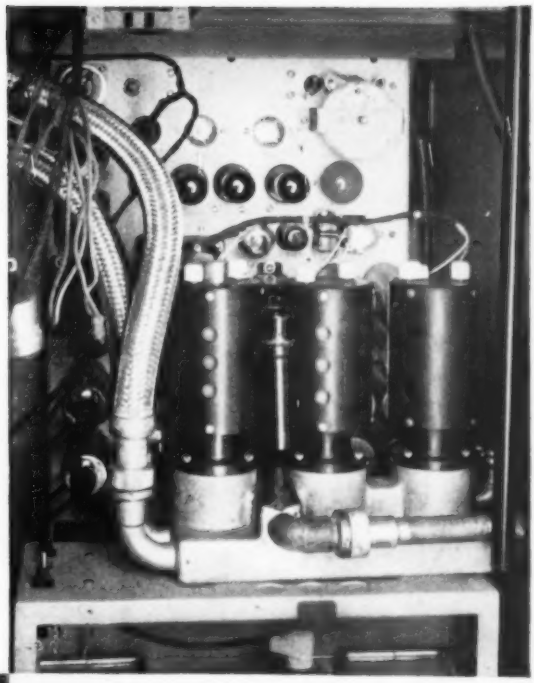
PQ-2

WARREN PUMPS

WARREN STEAM PUMP COMPANY, INC., WARREN, MASSACHUSETTS

RCA

uses flexible connectors for RIGID performance



The famous RCA Electron Microscope enables man to magnify the infinitesimally small on a scale that would make a postage stamp appear the size of a ball park. It does it with a beam of electrons, themselves so small that even a molecule of air may deflect them.

This calls for high vacuum—a vacuum of only 1/10,000,000 of an atmosphere. The connections between the pumps that create this vacuum and the vacuum chamber of the microscope must be flexible for reasons of assembly, minimized vibration and ease of adjustment. So RCA engineers specified seamless flexible metal tubing.

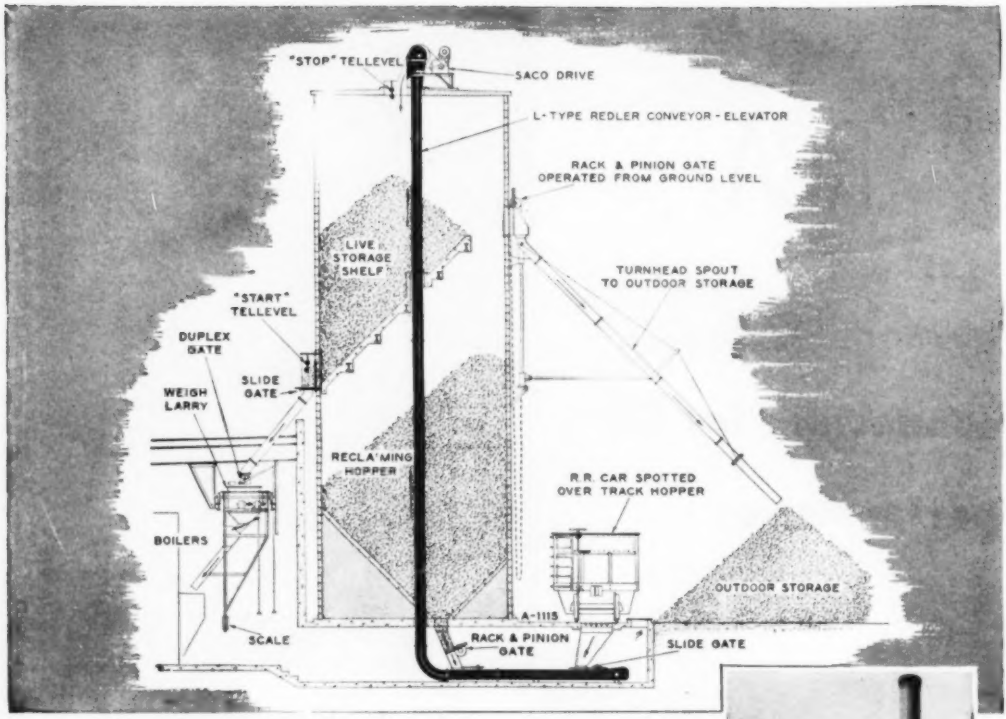
This is a dramatic example of how American Seamless Flexible Metal Hose and Tubing – tight, strong and corrosion resistant – can provide *flexible* connectors for almost any liquid, gas or semi-solid; can connect piping or parts that vibrate, move or are out of alignment.

Let our Technical Department help you with your problem. Also, write today for Bulletins SS 50 and CC 300. The American Brass Company, American Metal Hose Branch, Waterbury 20, Connecticut. In Canada: The Canadian Fairbanks-Morse Co., Ltd.

ANACONDA

wherever connectors must move **American**

FLEXIBLE METAL HOSE AND TUBING



UP goes coal DOWN come costs!

Twenty tons of coal per hour—stored and reclaimed as needed—that's the day-in, day-out performance of this REDLER conveyor-elevator, *engineered for the job* by Stephens-Adamson. For fifty years S-A has been designing and installing coal and ash handling equipment. In every field of industry S-A engineering is proving outstanding superiority *on the job*—with maximum efficiency and minimum costs! If YOU have a bulk material handling problem, you are invited to consult with S-A engineers—at once and without obligation.

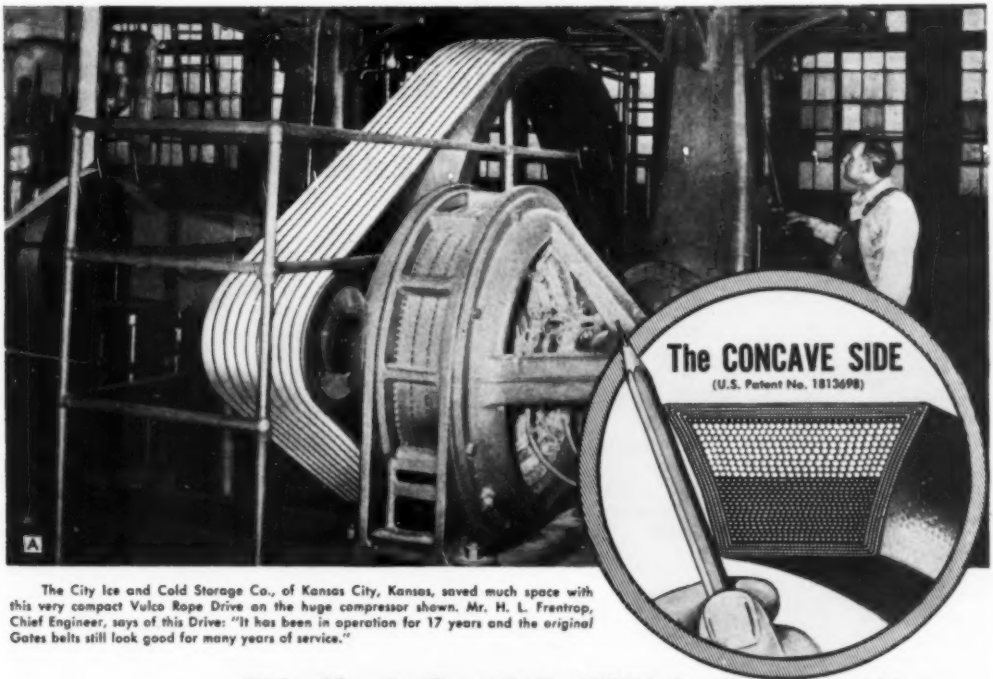
STEPHEN S-A DAMSON

21 Ridgeway Avenue, Aurora, Illinois MFG. CO. Los Angeles, Calif. • Belleville, Ontario

THE BORDEN COMPANY
Clintonville, Wis.

Lower horizontal run of Redler picks up coal from under track hopper and curves into vertical run for elevation to discharge point at top of silo. When live storage shelf is filled, coal spills over into bottom of silo where it is reclaimed as needed. Coal on live storage shelf can be directed by a chute through roof of boiler house where a duplex gate discharges to an S-A weigh larry which can be moved to discharge into either of two boiler stokers. Tellevel storage control units regulate volume of coal in live storage.

DESIGNERS AND MANUFACTURERS OF ALL TYPES OF BULK MATERIALS HANDLING EQUIPMENT



The City Ice and Cold Storage Co., of Kansas City, Kansas, saved much space with this very compact Vulco Rope Drive on the huge compressor shown. Mr. H. L. Frentrop, Chief Engineer, says of this Drive: "It has been in operation for 17 years and the *original* Gates belts still look good for many years of service."

This Simple Test Tells WHY the Concave Sides of Gates Vulco Ropes Mean *Longer Belt Life!*

Prove this *yourself*—in two minutes' time.

Take any V-belt that has *straight* sides. *Bend* that V-belt while you grip its sides between your fingers and your thumb. You will *feel* the sides of the belt *bulge out*—as shown in figure 1-A, below.

Clearly, that outbulge forces the sides of the belt to press *unevenly* against the V-pulley—and this concentrates the *wear* where the bulge is greatest.

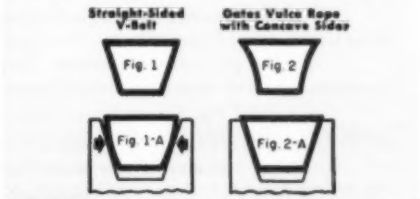
Now, make the same test with the belt that is built with the Concave Sides—the Gates Vulco Rope.

Figures 2 and 2-A show clearly what happens when you bend a Vulco Rope. Instead of *bulging*, the precisely engineered Concave Sides merely *fill out* and become perfectly straight. There is no side-bulge. This belt, when bent, precisely fits its sheave groove.

Because there is *no bulging*, the sides of the Gates Vulco Rope always grip the *full* face of the V-pulley *evenly* and therefore wear *uniformly*—resulting in *longer belt life* and *lower belt costs for you.*

Only V-belts made by Gates are built with concave sides. Whenever you buy V-belts, be sure that you get the V-belt with the Concave Sides—The Gates Vulco Rope!

What Happens When a V-Belt Bends



How Straight-Sided V-Belt Bulges in Sheave-Groove. Sides Press Unevenly Against V-Pulley Causing Extra Wear At Point Shown by Arrows.

The Concave Sides Fill Out to a Precise Fit in the Sheave-Groove. No Side Bulge! Sides Press Evenly Against the V-Pulley—Uniform Wear—Longer Life!

CS-511

THE GATES RUBBER COMPANY
DENVER, U. S. A.
The World's Largest Makers of V-Belts

Gates VULCO ROPE DRIVES
Engineering Offices and Jobber Stocks IN ALL INDUSTRIAL CENTERS of the U. S. and 71 Foreign Countries

AEROTEC GAS SCRUBBERS KEEP THE *Big Inch* CLEAN

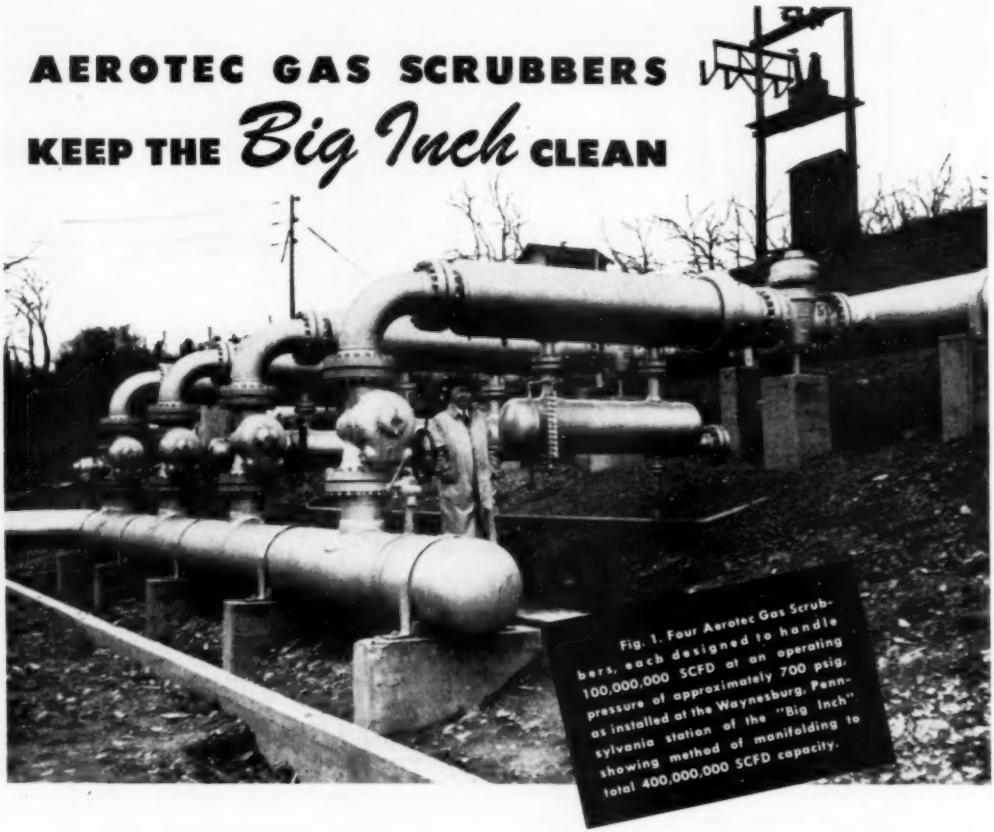


Fig. 1. Four Aerotec Gas Scrubbers, each designed to handle 100,000,000 SCFD at an operating pressure of approximately 700 psig, as installed at the Waynesburg, Pennsylvania station of the "Big Inch" showing method of manifolding to total 400,000,000 SCFD capacity.

From Texas to Pennsylvania, Aerotec Gas Scrubbers, stationed along the BIG INCH, remove water, distillates and dust.

Above is the Aerotec installation at Waynesburg, Pa. Installed for Texas Eastern Transmission Corporation, this 400,000,000 SCFD unit is typical of manifolding possible, with standard 100,000,000 SCFD units, for increasing capacity.

The Aerotec method of separating gas from foreign material is a dry process. Since no oil or other liquid is used for separation, no carryover of these cleaning mediums into the gas stream is possible. This basic advantage eliminates the difficulties normally encountered in conventional types of scrubbers.

Aerotec Gas Scrubbers are available in practically any size up to 100,000,000 SCFD. For larger capacities, units may be manifolded as described above.

Catalog 501 on this new method is available on request. Write for it today!

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THE AEROTEC CORPORATION

GREENWICH, CONN.

INDUSTRIAL POWER

March, 1951 Vol. 60, No. 3

Recovery furnace and boiler are housed in this new structure, while quintuple effect evaporators are located outside at the left. Liquid chlorine can be used from tank cars and the railroad unloading station

MEAD'S KINGSPORT MILL POSTWAR MODERNIZING WAS 5 STEP PROGRAM

This five point program inaugurated an increased plant efficiency, reduced the water and air pollution, and salvaged by-products. A lime kiln, six pulp digesters with auxiliaries, soda recovery furnace, fly-ash collectors, and an improved ventilation system were installed

A. S. WELLS, *Div. Engineer, The Mead Corp., Kingsport Div.*

TO KEEP PACE with the paper industry's postwar trend toward better products, greater output and realistic costs, The Mead Corporation's Kingsport Div., Kingsport, Tenn., completed an extensive mill modernization project. This unit, in operation for the past several months, has demonstrated the potentialities in new processing efficiencies and increased operating economies.

Signalizing another phase of a long-term expansion-improvement program, the project aptly reflects management's belief that increased efficiency and productivity will provide the means of keeping pace with continued heavy demands for the company's quality book, magazine and converting papers.

Launched right after the end of the war, this project serves as an interesting case study of what can be achieved, through modern process engineering techniques and equipment integration and provides new productive life in a 30-year-old soda pulp mill. Also, it illustrates a practical approach to the increasing interest in reduction of stream and air pollution. This problem, common to all industry in view of concerted emphasis on better community relations, holds particular significance to modern mill management.

Briefly, the initial efficiency-reconversion job completed by Mead engineers at their Kingsport mill embraced the building of a lime kiln, installation of six modern pulp digesters with auxiliaries, a new soda recovery furnace, equipping boilers with fly ash collectors and improving the mill ventilating system.

Changed economic conditions and management's efforts to reduce material waste in process made a new lime kiln an item of importance. In causticizing, liquor for cooking pulp is made by reacting soda ash with lime. A by-product, lime sludge, when reburned produces lime that can be recycled to the causticizing operation. Hence,

fresh lime purchased on the market is replaced or reduced substantially, effecting an important saving in this essential pulp and paper-making material.

Mead has recognized for years the desirability of burning lime for this purpose. However, until recently, the low delivered price of new lime outlawed the equipment investment costwise. Also, with a certain portion of this sludge used as filler in paper, experiments were being carried on at Kingsport directed toward furthering such use. As a result surplus sludge was washed to the sewer with other mill effluents, but the economic perspective of this general picture changed as lime prices continued to advance.

Cooperative Design

Engineering design, purchase and installation of a new lime kiln were handled by Tidewater Construction Co., Norfolk, Virginia, in cooperation with Mead engineers. Construction of the unit, 9 ft in diameter and 170 ft long, was started in March, 1948. Placed in production eight months later, the kiln has turned out approximately 40 ton of burned lime per day from 65 to 70 ton lime mud (62% moisture content) during the causticizing operation. About 3,000 gal of fuel oil were burned and 2700 kw hr of electricity consumed to turn the kiln and operate air blowers, pumps and other auxiliaries.

Gases formed in burning lime sludge are passed through a Rotoclone-type scrubber, thereby minimizing objectionable fly ash release to the atmosphere. Results obtained to date with this new lime kiln have been somewhat better than expected. Quality of lime produced is very satisfactory, and discharge of sludge into the sewer is now negligible, having been eliminated entirely for all practical purposes. While operating costs on the basis of present tonnage requirements are higher than first estimated, they are still low enough to show worthwhile economies and possible monetary savings.

Digester Installation

Second major postwar improvement made at the Kingsport mill called for replacement of ten digesters. These units were in continuous service for over 20 years and had been worn so thin in places by the erosive action of caustic soda cooking of pulp that they no longer could be operated safely at required steam pressures. Production losses ensued in operating the units at reduced pressures.

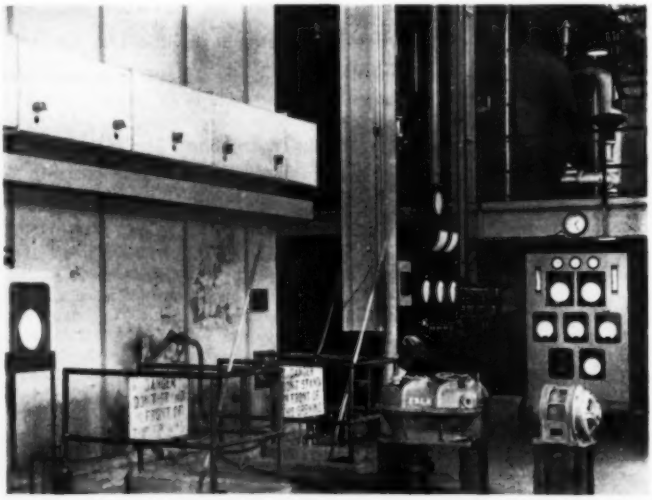
This job was not one of merely replacing duplicate digesters as had been the case in 1925. Rather, it demanded integrated design engineering, as their installation would furnish the first step in what ultimately will be modernization and expansion of the total old mill. As such, Mead's management specified that the new digesters incorporate all the features representative of modern engineering concepts and consistent with good chip-cooking practice. Among the refinements sought were increased capacity, forced circulation of liquor, automatic relief, full instrumentation and efficient heat recovery.

Other important considerations also were involved. Digesters had to be conveniently located and their operation effectively coordinated, so as to become a basic part of an integrated process layout and operations plan for the entire mill. Moreover, they had to be planned, delivered and installed as quickly as possible. Meanwhile, production of the old equipment had to be maintained at a relatively good level until the new units could be put into final operation.

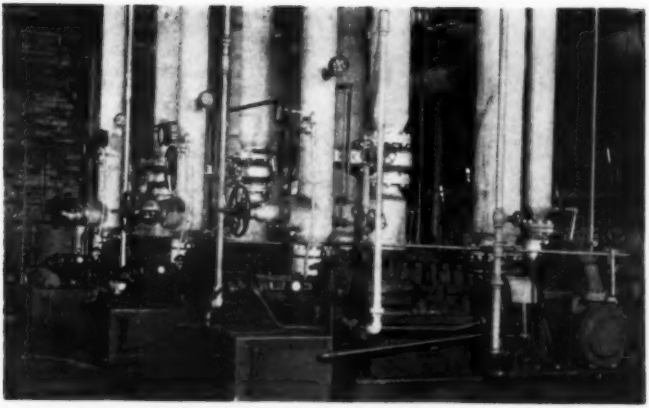
Teamwork between Mead technical personnel and engineering consultants solved this complicated problem. For Mead, important contributions were made by development, operating, engineering and supervisory executives.

Construction of six digesters, started

Digesters, located at the operating floor level, are charged from large capacity overhead chip bins equipped with a Redler distribution system. (see third digester)



Recovery furnace and smelt spouts in guarded area, where workers can operate with comparative safety. Smelt dissolving tank is located below mechanical agitator



Five-stage feedwater pumps are driven with steam turbines operating at 140 psi, 460F and 5 to 35 back pressure. The water is circulated against a 3,000 ft head

in early 1948, were completed in the spring of 1949. Production performance of these units, together with their controls and auxiliaries, is proving the value of careful design and control features. The digesters are 11 ft in diameter and 49½ ft high, with a pulp capacity per unit of 10 ton and a volume of 3900 cu ft of chips per charge. Presently, these digesters are producing 140 ton of pulp daily, but they are designed and engineered to provide a maximum capacity of 225 ton.

Auxiliaries include six liquor heaters and six 2,500 gpm liquor-circulating pumps, a heat recovery system, elevators, chip conveyers, automatic controls and instruments and stock and water pumps of 300 to 1,000 gpm capacity.

Handling Chips

The chip conveyer system runs from the chipper screens to the chip storage bins and is worthy of special note as it has been designed expressly to provide for a better, more even distribution of chips and so increase chip bin capacity. There are two conveyers. The first is a 30 in. rubber belt running from chipper screens to a belt bucket elevator, 120 ft high, and has a capacity of 80 ton per hour traveling at 300 fpm. Above the chip bins is a Redler run-around conveyer equipped with a series of special gates. With chips distributed more uniformly, chip bin capacity has been increased approximately 50 per cent. All pumps serving the digesters are automatically controlled from pushbutton stations.

Soda Process

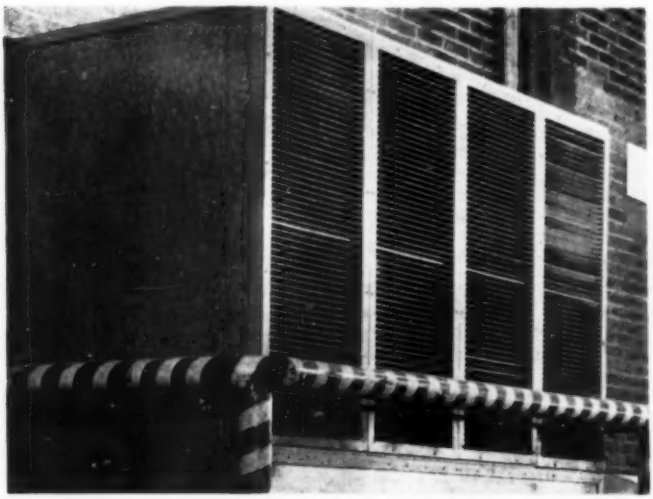
When making pulp from hard woods by the "soda process" (cooking chips with caustic soda as the chemical reagent) it is customary practice to use furnaces and auxiliary equipment for partially recovering caustic from the spent liquor drained off the newly-cooked chips. Since 1916, when the first recovery setup was installed at Kingsport, the arrangement utilized consisted of an evaporator to condense the liquor to about 50 per cent solids, a rotary furnace or incinerator, a fire-pot or furnace for coal burning heat and a small fire-tube steam boiler through which exit gases pass prior to discharge into the atmosphere.

Between 1916 and 1941, six such integrated units were installed with a total capacity of 132 ton. Chemical recovery approaching 90 per cent is possible with consistently efficient operation, but 85 per cent is regarded as good performance. Recovery of as low as 75 per cent is not unusual. Chemical recovery, however, presents its problems. Labor and maintenance costs, for instance, are frequently rather high, heating value of the carbon in the liquor is largely wasted and steam output is low. Furthermore, due to low unit capacity, a multiplicity of units is required. Add to these the problems of waste disposal caused by the emission of heavy clouds of smoke and dust into the atmosphere and carbon residue in large amounts that must be washed to the sewer.

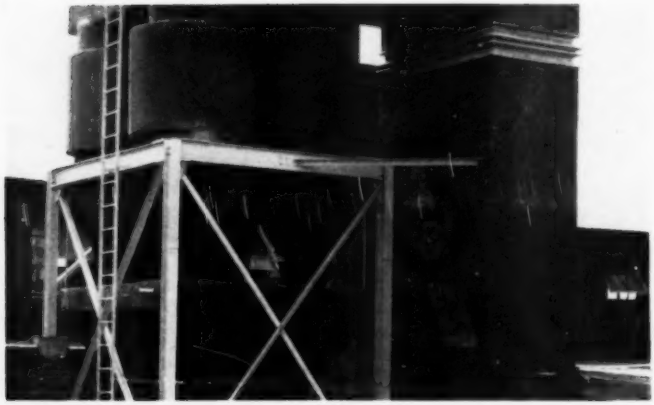
Waste Disposal

Interest of management in curbing and controlling the disposal of these wastes antidates the postwar period by a good many years. In fact, it goes back to 1930, when the company installed at its Chillicothe, O., mill a new type liquor recovery furnace that gave promise of operating with infinitesimal air and sewage loss. A similar trial installation was made in 1939 at the pulp mill in Brunswick, Ga. Thus having contributed through these pioneer trial installations to the development of this furnace, it was only natural that in 1947 the company specified the latest designs.

Ground was broken for the Kingsport unit in February, 1948. The first liquor was burned in July, 1949. Following a three-week "shakedown" period, this furnace took over the entire



Air distribution units, placed strategically around the plant, handle 400,000 cfm of outdoor filtered air of which 200,000 cfm is heated during the winter



High efficiency dust collectors have reduced the ash discharge to less than 0.35 grains per cu ft, the specified limits of Kingsport's dust and smoke ordinance

liquor burning and soda recovery load.

After evaporation to a solution of better than 60 per cent solids and 40 per cent water, the pulp mill liquor is burned in a furnace (18 ft wide, 21 ft long, and 70 ft high) in a mist-spray form produced by steam-atomizing nozzles similar to those found in conventional fuel oil burners. Greatest portion of the chemical present in the liquor then drops to the chrome-ore-faced furnace bottom and flows as a red-hot molten stream of "smelt" through spouts into a heavy brick-lined tank. Here, aided by vigorous agitation and pumped recirculation, it dissolves in the liquid and is pumped to the causticizing department for treatment and for further usage.

Furnace Construction

Tubes forming the furnace walls constitute an integral part of the water-circulating system of what, in effect, is a huge central station type of high-pressure steam boiler. It absorbs radiant heat of the furnace flame and heat of gases flowing through the boiler, economizer and air heater tube sections, and generates steam at a pressure of 900 psi at a total temperature of 750 F. Furnace and boiler are designed to provide 107,000 lb of steam per hour at 900 psi and 750 F superheat, based on 225 ton daily mill pulp production.

Gases leave the boiler and pass through a scrubber cyclone evaporator tower, which recovers dust carryover. Then, before discharging into the atmosphere, gases flow through an electrical precipitator, which collects all but a trace of the remaining residue of dust. With this furnace and auxiliaries, only a light white plume of fog — mostly condensing water vapor, or the water that was present in the liquor as it entered the furnace—is emitted from the chimney.

This soda recovery furnace installation is equipped with three turbine-driven, automatically regulated boiler-feed water pumps, which provide a capacity of 300 gpm against a maximum net total dynamic head of 3,000 ft handling feedwater at a maximum temperature of 228 F. These five-stage pumps discharge into a stage heater, a deaerating type unit specially designed to handle maximum feedwater output of 200,000 lb per hr. Feedwater enters the heater at 228 F and leaves at 268 F. Heating medium is 30 psi steam at 350 F. Steam turbines operate at 140 psig, 460 F at the throttle and exhaust at 5 or 35 psi.

The boiler is equipped with soot blowers, which are automatically controlled from a panel located on the operating floor 20 ft above grade. Other auxiliaries are liquor pumps, forced and induced draft fans, and feedwater-treating equipment.

Smoke Abatement

When the City of Kingsport put its dust and smoke control ordinance into effect in June, 1948, the problem of eliminating or reducing dust output from three pulverized coal-fired boilers had been under scrutiny by company engineers for over five years. As the initial approach, larger slow speed induced draft fans had been installed to provide required draft for boiler operation with fly ash collectors. Following careful study and analysis, the engineering staff recommended the purchase of high efficiency mechanical dust collectors to comply with the local ordinance.

Engineering details in combining these units into a coordinated system, with higher capacity drive units for induced draft fans, duct work and controls was handled by the division engineering department. Installation was made by the division maintenance department. Power plant load conditions and delivery delays on some essential auxiliary equipment items prevented completion of the work in July, 1949, as originally scheduled. However, in October, when a continuous flow of steam became available from the new soda recovery unit, the boilers were scheduled for shutdown, one at a time, for final tie-in of the collector systems.

Boilers are operating with a dust load of less than 0.35 grains per cu ft when figured at a temperature of 350 F, and when gases do not contain more than 50 per cent excess air — the speci-

(Continued on page 104)

PRINCIPAL EQUIPMENT FOR KINGSPORT MODERNIZATION

Lime kiln	Allis-Chalmers Mfg. Co.	Stock and water pumps	DeLaval Steam Turbine Co.
Preliminary and semi-final design	Hardy S. Ferguson Co.	Liquor recovery furnace	The Babcock & Wilcox Co.
Final design and construction	The Austin Co.	Electric precipitator	Koppers Co., Inc.
Digesters	Blaw-Knox Co.	Boiler feed pumps	DeLaval Steam Turbine Co.
Liquor heaters	Fibre Making Processes Inc.	Deaerating stage heater	Cochrane Corp.
Liquor circulating pumps	Worthington Pump and Machinery Corp.	Steam turbines	DeLaval Steam Turbine Co.
Heat recovery system	Swenson Evaporator Co.	Soot blowers	Diamond Power Specialty Corp.
Elevators	Salem Elevator Works	FD and ID fans	American Blower Corp.
Conveyers	Stephens-Adamson Mfg. Co.	Feedwater treatment	The Permutit Co.
Controls and instruments	The Foxboro Co.	Ventilation equipment	Ross Heater & Mfg. Co., Inc.

Water intakes, in cooling ponds, should be away from the shore and as deep as possible. Discharge is at shore line

Spray ponds are ideal for large cooling capacity when the space can be spared and drifting is of little consequence

THE PROPER WATER TOWER MEANS WATER CONSERVATION

During the present emergency it is all the more important to save and economize our great natural water supply. This author discusses the various types of water cooling methods now employed and how best towers can be utilized for the efficient cooling and reuse of water

HOWARD E. DEGLER, ***Technical Director***

The Marley Company, Inc.

WATER is America's No. 1 natural resource and is as essential to industrial life as to animal and plant life. It is a universal solvent, catalyst, tireless medium for transport of materials, disposal of wastes, cooling agent, dispersive medium, cleansing vehicle and vital essential for production and distribution of process heat and power.

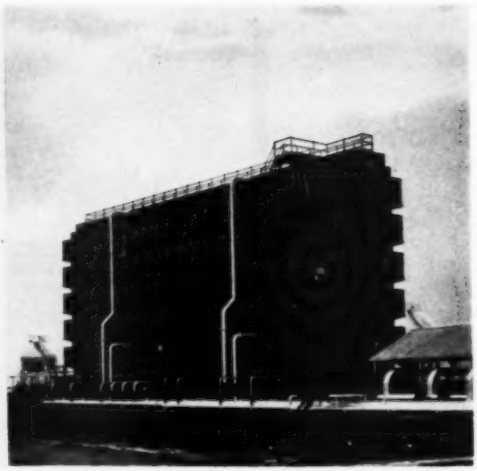
During the past decade the average peak summer demand for water in USA cities has increased from 100 to 200 gal per day per person. This has resulted in present-day problems of (1) inadequate sources of water, (2) inadequate purification and distribution systems or (3) inadequate sewer disposal and waste systems.

Water problems may be divided into five groups, ground water, surface water, pollution, recharge and re-use. In general, the quantity and temperature of water available are of the utmost importance, far outweighing considerations of quality. But the quality of the water supply cannot be entirely ignored because dissolved salts, gases or other impurities can corrode or foul heat exchangers. Depletion of ground water has made necessary the use of more and more surface water, which in turn may be polluted and requires treatment before distribution.

Selection of the most feasible water-cooling method becomes more important as power demands increase and industries expand their capacity. There is plenty of water, at a price. Since the past decade's doubled demand for water, underground sources in many areas have become dangerously depleted by overuse. Run-off water is residual, it is that which remains on the earth's surface after the prior claims of evaporation, transpiration of plants and absorption by the ground have been satisfied. During the past 40 years progressive improvement of methods for cooling and subsequent re-use of water has been utilized in the following sequence: (1) rivers, lakes, wells and cooling ponds, (2) spray ponds, (3) evaporative condensers, (4) natural-draft water-cooling towers, (5) forced-draft cooling towers, (6) induced-draft cooling towers and (7) dry-surface coolers.

Progress of the water-cooling equipment industry is apparent. For example, a modern cooling tower requires only 1 sq ft of ground area as compared to 50 sq ft for spray ponds and about 1000 sq ft for a natural cooling lake. The

Forced-draft cooling towers are suitable for corrosive water. Low air velocity discharge can cause recirculation



Natural-draft towers are installed so the long side faces in the direction of the prevailing wind for best efficiency

continuous demand for a more compact design, better construction, lower cost, larger capacity, greater flexibility of operation, independence of atmospheric uncertainties and improved all-around performance has resulted in the modern induced-draft water-cooling tower.

Available Water

More surface water is available than is drawn from under-ground sources in most areas. Quantity of water used to be the basic consideration of available water supply; a question of flood or drought possibilities. More important is the question of quality and temperature of the process water. Upstream contamination of surface water is indeed a controlling factor in many areas. Every process engineer is confronted with the overall surface-water problem of stream (or lake) pollution, effluent control and water purification.

Lakes and cooling ponds have been used as a source of process water, the hot water being discharged close to the surface at the shore line. Natural air movement over the surface of the water causes evaporation over that area, thus carrying away the heat. Increased density of the water due to loss of heat causes the cooled water to sink to the bottom of the pond. The suction connection should be as far below the surface as possible and as great a distance from the discharge as practicable. The area required by cooling ponds of this type is about 50 times that of a spray pond so as to dissipate the same quantity of heat.

Spray ponds consist of a water-collecting basin, above which nozzles are located to spray the water upwards into the air. Properly designed spray nozzles break the water up into small drops, but not into a mist. Since the objective is cooling, the individual drop must be heavy enough to fall back into the pond and not float away in the air. Louver fences to prevent carrying of entrained water beyond the edge of a spray pond are required for all roof locations and for ground locations where space is restricted to a great extent.

Spray ponds are recommended only for large-capacity services where high efficiency in a limited area is not demanded, and drifting moisture is not objectionable. They are inexpensive and entirely satisfactory when correctly applied to those services to which they are applicable. Pumping requirements and basin costs are generally disproportionate with modern induced draft cooling.

Cooling Principle

Water-cooling towers are enclosed devices for evaporatively cooling water by contact with air. In atmospheric water-cooling equipment the heat transfer is partially sensible (about 25 per cent) plus an exchange of latent heat (about 75 per cent) resulting from the evaporation of a small part of the circulating water. In a natural draft water-cooling tower air movement is dependent only upon atmospheric conditions.

A spray-filled water-cooling tower (natural draft or mechanical) is dependent solely on spray nozzles for water break-up. A deck-filled tower contains baffling to increase the water break-up and to provide additional wetted surface. Mechanical-draft water-cooling towers utilize one or more fans to move air, the fans being an integral part of the tower. Forced-draft towers have one or more fans located in the air stream entrance. Induced-draft water-cooling towers have one or more fans located in the air stream outlet.

Natural-Draft Cooling Towers

When water-cooling requirements are less than 30,000 Btu per minute the spray-filled natural-draft tower is satisfactory. The word "tower" used in this connection is a misnomer, as the design simulates a narrow spray pond with elevated nozzles and a high louver fence. As usually built, the nozzles spray downward from the top. Center of the nozzle system to the fence on either side is not more than half the distance the nozzles are elevated above the water basin. Heights range from 6 to 15 ft, with the total width of the structure usually not greater than the height. Loadings range from 0.6 to 1.5 gpm per sq ft of tower area, about one-fourth the area of an equivalent spray pond. Louvers are continuously wet, adding to the surface of water exposed to the air.

Drift is considerably less in a properly designed natural-draft tower than in the spray pond, but even so it may become a nuisance. For this reason natural-draft towers are unsuitable for downtown building roofs, locations adjacent to buildings or near expensive mechanical equipment in industrial plants. They must be located in an open area, broadside to the prevailing wind. These towers are generally unattractive, and since they are long and high must

be securely anchored to prevent uplift or overturning during high winds. High pumping requirements and total dependence upon atmospheric caprice, especially wind are disadvantages.

A natural-draft tower, either spray-filled or deck-filled, can be utilized when the equipment served can stand a few degrees rise in the cold-water temperatures at low wind velocitys; when the drift from the tower is not objectionable to the surrounding territory and when it can be located so that the wind will not be obstructed.

Mechanical Draft Towers

Mechanical-draft towers consist usually of a vertical shell constructed of wood, metal, asbestos-cement board or masonry. Water is distributed near the top uniformly over the area and falls to the collecting basis in the bottom. Air is circulated in the tower from bottom to top by forced or induced draft fans or horizontally in double-flow towers. Since the air passes counterflow or "crossflow" to the water, it is in contact with the hottest water just before leaving the tower.

Hence, a given quantity of air picks up more heat than the average equal quantity of air on natural-draft equipment. This permits the water to be cooled with the least quantity of air required by any type of cooling equipment. As movement of air through the towers is obtained by power-consuming fans, it is essential that this air quantity be reduced to the minimum so as to secure low operating cost.

Mechanical draft towers may be spray filled from nozzles or packed with wood filling with water cascading from top to bottom. In the spray-filled mechanical-draft tower, the area presented to the air is the combined surface of the small drops in the tower at any one time. The net, free cross-sectional area of the air spaces is greater than that of the wood-filled tower for the same plan area. This results in lower air velocities and a shorter time of contact between air and water. Before discharging to the open atmosphere, the water-laden exhaust air passes through a drift eliminator to remove entrained unevaporated water, which might be carried by air movement.

In the wood-filled tower, pieces of lumber are laid horizontally across the space on close centers without introducing too great a resistance to air flow. Water is distributed over the top layer by means of spray nozzles, troughs, splash heads or through evenly spaced nozzles located in the floor of an overhead open-type water distribution basin. As the air moves upward the filling presents a large wetted surface and repeatedly breaks up the falling drops of water. This provides new drop surfaces whose integrated areas are several times the wood-filled area.

Performance Factors

Efficiency of a mechanical-draft tower is improved by increasing the filling, height, area or air quantity. Height increases air contact without affecting fan power but the pumping power increases. Increasing the area with constant fan power increases air quantity and contact with the water because of lower velocity. The surface area of water in contact with the air is increased in both cases.

Increasing the air decreases contact time, but since a greater quantity is passed the average differential between the water temperature and wet-bulb temperature of the air is increased speeding up the heat transfer rate. Increased air quantities are obtained only at the expense of increased fan power, which increases approximately as the cube of the air quantity. Air velocities through mechanical draft towers vary from 250 to 400 fpm over the gross area of the structure.

Mechanical-draft tower performance is independent of wind velocity. Hence, it is possible to design them for more exacting performance. They require less space and piping than atmospheric type towers. The pumping head varies from 10 to 25 ft, depending upon the design. Overall plant economy resulting from colder water usually offsets the additional operating expense and initial cost as compared to atmospheric or gravity type towers.

Forced-draft type of water-cooling towers has one or more fans located in the air entrance and is suitable for corrosive waters. Fans are mounted near the ground level on a rigid foundation where it is easily accessible. Operating costs are high because of high fan-power requirements. Maintenance and depreciation both are high by modern standards. The greatest objection to the forced draft tower is heated air leaves the top at a low velocity and is subject to "recirculation" to the fan inlet. This action reduces performance, sometimes as much as 20 per cent.

During cold weather, recirculation may cause ice formation on adjacent equipment and buildings as well as in the fan ring with possible resultant fan breakage. Their limited fan size (12 ft or less) means more fans, motors, starters and wiring in larger capacities than are needed by induced draft towers, the latter can use fans as much as 20 ft in diameter. Location of fans on top makes the induced draft type a sounder structure and minimizes noise. It offers a neater appearance and has a ready adaptability to architecture.

Counterflow (conventional) type of induced draft tower has the fan located on top to provide vertical air movement across the filling. Discharge is upward at a high velocity to prevent recirculation. Another type (small requirements) has the induced draft fan in one end, to provide horizontal flow. Demand for a more compact design, better construction, lower cost, larger capacity, more flexible operation and improved all-around performance has produced the double-flow (also called cross-flow) induced draft cooling unit.

This distinctive tower uses horizontal air flow with fans centered along the top. Each fan draws air through two cells paired to a suction chamber. Partitions midway beneath each fan are fitted with "drift eliminators" that turn the air upward toward the fan outlet. This tower obtains a horizontal air movement as water falls in a cascade of small drops over the wood-filling and across the air stream with low resistance to air flow. The air travel is longer than with the conventional counter-flow design.

Double-flow water-cooling towers employ a low pumping head, varying from 14 to 30 ft. Operating advantages include: (1) horizontal (crossflow) air movements as water falls in a cascade of small drops over the filling and across the air stream, (2) offers less resistance to air flow, therefore a lower draft loss, (3) has longer air travel than is practical with the conventional design, (4) open water-distribution basin, which is accessible for cleaning during operation and (5) has a close-space wood diffusion deck under the water basin to provide uniform water distribution to the wood filling.

Most cooling tower manufacturers limit the water loading to a maximum of 6 gpm per sq ft because of the blanketing effect of the spray. But, heavier loadings, up to 10 gpm per sq ft, are possible in crossflow towers. A modern double-flow water-cooling tower occupies less than one-twentieth of the area required by a spray pond for equivalent service.

The second and concluding part of this article will appear in the next issue of INDUSTRY AND POWER. The author will offer suggestions on proper cooling tower selection.

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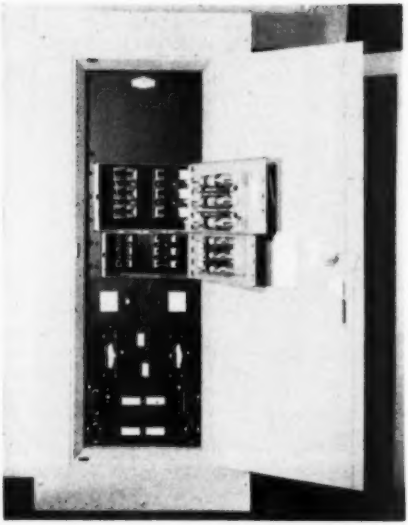


KNOW YOUR FUSES

Each type of low voltage fuse has characteristics which suit it to a particular phase of circuit protection. This is how they react to various circuit conditions and how proper choice can lower equipment cost. Special attention is given to the more recent dual-element fuse

J. C. LEBENS, *Chief Engineer,*
Bussmann Manufacturing Company

Protection given by these safety valves of the electrical system, left, may be limited to short circuits only or it may extend to the prevention of burned out panels as well as overloaded motors

POWER FUSES rated at 600 v or less, commonly called low voltage fuses, are available in three basic types —non-renewable, renewable and dual-element.

The non-renewable is the oldest and most common type. Fundamentally, it consists of a zinc link surrounded by an arc-quenching filler, has very little time-lag and, on motor circuits, its rating must be several times that of the protected circuit to eliminate blowing on harmless overloads. Hence, there is a range (between full load capacity of the circuit and the rating of the fuse) in which the circuit can be damaged without causing the fuse to operate. For this reason, principal function of the non-renewable fuse is to isolate faults and protect the circuit against short-circuit currents.

English engineers have exploited this feature and have enhanced the interrupting capacity. By using silver instead of zinc for the fuse link, cross-sectional area of the link is reduced because of the greater conductivity and higher melting point of silver. This decreases the amount of material to be volatilized on short-circuit, providing faster performance and opening the circuit before the current can build to maximum heat value available. Greater current-limiting action is thus obtained from the silver link.

Short-Circuit Performance

However, performance of fuses under heavy short-circuit conditions is so fast that all of them limit fault currents actually flowing to less than the peak available. Normal time of opening under heavy fault conditions always is less than one cycle and often is of the order of one-quarter cycle. Although the effect is enhanced in the silver link fuse, it is designed for fast action without time-lag and it must be rated to handle transient overloads greater than the continuous capacity of the circuit.

Renewable fuses represent an improvement over one-time units. Cost of replacement is reduced. By building the case stronger, the arc-quenching filler is eliminated, simplifying renewal of the fusible element or link. However, principal interest lies in the fact that time-lag has been incorporated and the rating can more nearly approach that of the circuit.

Time-lag has been provided by means of reduced sections, or weak spots, adjacent to wide sections loaded with zinc lag plates to increase thermal capacity. Current flowing through the link generates heat in the weak spots. At the low overloads, this heat flows into the lag plates and raises the temperature slowly. Hence, it takes longer for the renewable fuse to blow on the low, temporary overloads.

At high overloads and short-circuits, there is no time for thermal conduction. Temperature of the weak spots increases rapidly to the melting point. Cross-sectional area of the weak spot of the renewable fuse is less than that of the non-renewable link because all the heat must be generated there. For this reason, blowing time of the renewable fuse is less under short-circuit conditions even though the time-lag is greater at the lower overloads.

Dual-element fuses represent culmination in the development of fuses giving complete protection. By combining a thermal cutout with a fast-acting link

TABLE 1—SHORT-CIRCUIT TESTS ON DUAL ELEMENT FUSES

250-v fuses on 240-v test circuit (165,000 rms amp on short circuit)

Rating, amps	Peak current, amps	Clearing time, sec	Peak voltage, volts
30	8,600	.0005	410
60	10,900	.0011	390
100	28,000	.0018	720
200	45,000	.0021	780
400	88,000	.0037	1930
600	119,000	.0049	1660

600-v fuses on 545-v test circuit (212,000 rms amp on short circuit)

30	14,000	.0007	770
60	22,000	.0010	1600
100	35,000	.0021	1720
200	53,000	.0036	2020
400	93,000	.0039	1650

in the same case, sufficient time-lag can be provided to eliminate blowing on useful overloads. A fuse size equal to or slightly larger than full-load current rating of the electrical equipment being protected may be chosen and any overload continued long enough to create a hazard opens the circuit.

The short-circuit protection strip in the dual-element fuse must be designed so that its interrupting capacity will be sufficient to handle any fault current which may develop in any power system in which it may be installed. Function of the strip can be isolated from that of the thermal cutout, making it possible to design for the short-circuiting consideration alone.

Until recently, the only short-circuit tests on fuses conducted by unbiased laboratories were those of the Underwriters' Laboratories made on direct current with only 10,000 amp available. Obviously, results obtained give little indication of performance on a-c circuits capable of delivering 50,000, 100,000, and 15,000 amp. Even though field experience with fuses has been unusually successful, responsibility of the designer to specify fuses without having complete interrupting test data available was so great that many hesitated to use them for applications where high fault currents were possible.

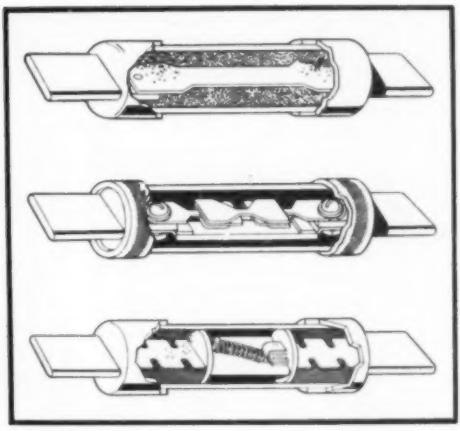
Test results, witnessed by the Electrical Testing Laboratories, on 250- and 600-v dual-element fuses are given in Table 1 and substantiate results obtained in the field. Test circuits were capable of delivering peak currents as high as 235,000 amp at rated voltage.

Test Circuits

Maximum current available at 240 v was 165,000 rms amp on a 60-c, 3-phase, 4-wire circuit, where a short between phases would place two fuses in series. 250-v units cleared the circuit without igniting readily inflammable material placed around the fuses and with comparatively little noise. In fact, it would be difficult to guess whether the fuse was interrupting a 50,000 or a 165,000 amp fault current.

Performance can be explained by the current limiting action of the fuse. Clearing time, which is total time from the instant the switch is closed until the current again returns to zero (including the melting and arcing time) is only .0005 sec for the 30 amp size and .0049 sec for the 600 amp fuse.

On a 60-c circuit, time for one complete cycle under steady state conditions is .0167 sec. Therefore, the 30 amp fuse clears the circuit in approximately 1/30 of a cycle and even the 600 amp size interrupts the 165,000-amp wave in approximately ¼ cycle.



Non-renewable fuses are insensitive to rate of heat formation, must have high rating for overloads like motor starting

Renewable links have weak spots that melt quickly on shorts, lag plates that soak heat away on lower transient overloads

Dual-element fuses have two end strips designed for instant flashing on faults. On minor overloads, center spring breaks soldered connection only after heat has raised temperature of heavy metal mount

This fast performance prevents the current from building up to the peak available and holds the transient recovery voltage to a nominal value, reducing danger of insulation flashover on associated equipment to a minimum. Even though 233,000 amp peak is available, the 30 amp fuse limits flow to a maximum of only 8600 amp.

Branch Fuses

Note that the larger the fuse the greater the peak current and the longer the time of operation. This effect is very desirable since fuses in the main panelboard are always larger than those in the branches. Any fault in the branch will be limited to a nominal value by the smaller fuse, which is the only one that need be replaced to restore service.

Tests also were conducted on 600 v fuses on a 3-phase, 4-wire circuit capable of delivering 212,000 rms amp at 545 v. Every test cleared the short-circuit, as before, without igniting readily inflammable material placed around the fuses, and with little noise. The results obtained, Table 1, are quite similar to those on the 250 v devices.

Because of associated savings, dual-element fuses give protection to electrical quipment and circuits at a lower cost than for ordinary fuses. The most interesting comparison can be obtained on fused switches used for the protection of a single motor.

Where hp-rated fused switches are required, ratings are based on the use of ordinary fuses. However, if dual-element fuses are used, the National Electric Code permits the use of a much smaller size switch. Proper ratings are shown in Table 2. Many manufacturers have their switches hp-rated for dual-element fuses and so marked so that the combination can be used for the protection of motors.

The smaller size switches cannot be used with ordinary fuses which have insufficient time-lag to carry starting currents of the motor. For example, a 15 amp motor requires a 60 amp switch with 45 amp ordinary fuses. But 15 amp dual-element fuses have sufficient time-lag to hold the starting current and only a 30 amp switch is necessary because fault currents are limited by the smaller rating.

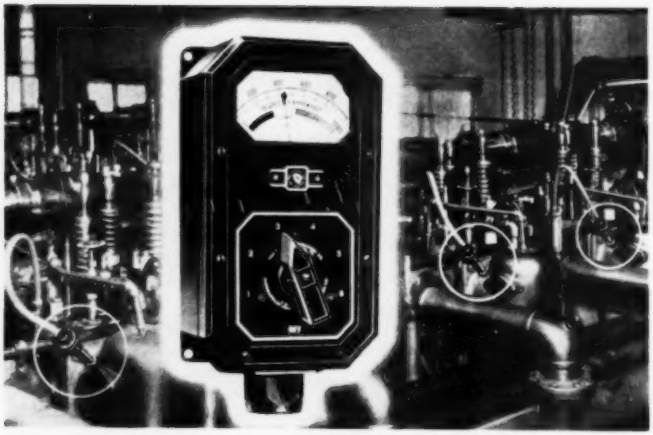
TABLE 2—SWITCH RATINGS, DUAL ELEMENT FUSED

Amp rating of motor	*Amp rating of switch*
0.0 to 20.00	30
20.1 to 42.3	60
43 to 68	100
69 to 134	200
135 to 268	400

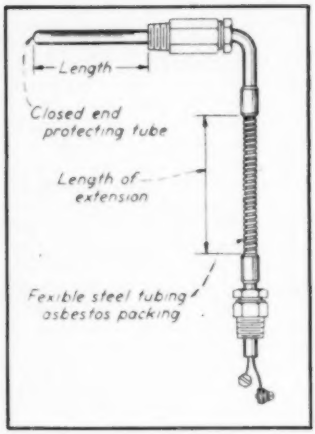
Thermal Protection

Furthermore, for equal protection of the motor, thermal overload relays must be used with the ordinary fuses. Dual-element units need no additional protective devices.

Dual-element fuses also permit loading of main switches and panelboards nearer their rating. Extra time-lag assures that the main fuse will not blow under harmless transient overloads. Lower resistance reduces the heating of the panel. The thermal protection afforded assures that damaging, heat-producing conditions, such as high-resistance contacts, will cause the thermal element to blow (at 280F) and warn the maintenance department that timely repair of the fuse clips, switch contacts, or terminal connections is required before heating and arcing destroy panel or components.



Indicating instrument, located centrally at the control panel, will instantly register exact temperatures of bearings, crankcase or exhaust through thermocouples



Thermocouple tubes should be removed regularly for inspection and cleaning

EFFICIENCY PLUS WITH PROPER INSTRUMENTATION

Practical information on the how and why of diesel instrumentation. This author brings out the advantages of perfect engine performance when engine, lube oil and jacket water temperatures along with pressures are automatically controlled and how equipment is protected

EUGENE B. SHEKER, *Application Engineer,*
Brown Instruments Div., Minneapolis-Honeywell Regulator Co.

DUE TO THE MANY improvements in the design of the diesel engine since it was first built in 1897, it has come into use as a prime mover in many fields of application. Irrespective of the design efficient engine performance is dependent upon an intelligent analysis of operating variables. However, instruments are necessary to measure, indicate and control, if possible, temperature, pressure and flow.

In addition to serving as a guide to engine performance, instruments provide automatic control facilities for regulation of variables, warning of abnormal conditions and shutdown in cases of emergency. Instruments with indicating or control facilities are required to measure: (1) temperature of cylinder exhaust, jacket water, lubricating oil and intake air; (2) pressure of fuel oil, lubricating oil, jacket water, starting air, injection air, intake air and scavenging air; and (3) flow of fuel oil and circulating water.

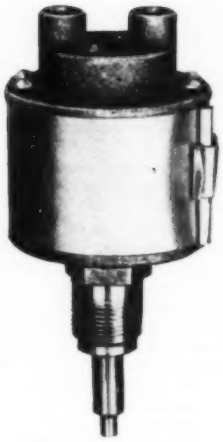
Diesel engines operate at the highest efficiency with the load evenly balanced between cylinders. Since exhaust temperature constitutes a reliable indication of load conditions for that cylinder, measurement and comparison of cylinder exhaust temperatures enable the operator to check and maintain engine load balance.

For the measurement of cylinder exhaust temperature, a pyrometer of the thermo-electric type is used. The system consists essentially of a thermocouple, extension wire and a deflection type indicating instrument. The thermocouple comprises two dissimilar elements (iron and constantan) welded together at one end. When the welded junction is heated a voltage is produced proportional to the temperature being measured. Voltage is transmitted to the indicator through extension wires.

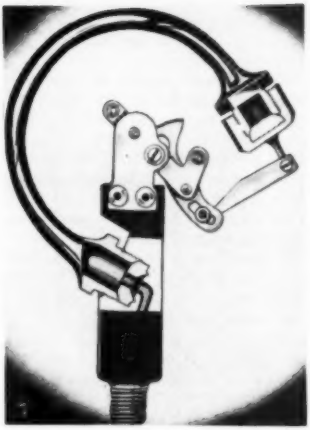
This instrument is of the conventional d'Arsonval type, operating on the principle that rotation of a spring-loaded coil in a steady magnetic field is proportional to current through the coil. Instrument accuracy is dependent upon its internal resistance in proportion to the resistance of extension wires and thermocouple. Therefore, it is desirable to use an instrument of high internal resistance.

Temperature readings depend directly upon the difference in temperature between the thermocouple hot junction and cold junction. For this reason, it is necessary to allow for ambient temperature changes at the cold junction. By using extension wires, which are of the same metals as the thermocouples, the cold junctions are transferred to the terminals of the selector switch on the indicator. Automatic compensation is provided at the instrument by a special resistance with a negative temperature coefficient so that actual temperature at the hot junction is read. Another means of automatic compensation is to use a be-metallic spiral, which is attached to the moving element so that a correction is applied in proportion to ambient changes.

The thermocouple is fitted into a protecting tube, which is inserted in the exhaust chamber. After the engine has been operating for some time protecting tubes often become coated with a carbon deposit, which acts as a heat insulator, causing considerable lag in temperature readings. Accordingly, the wells have been designed so that they can be easily removed from the exhaust



This controller, for jacket water contains a liquid-filled sensing element



Bourdon tube, left, has a built in magnifying mechanism for indicating pressures. Spiral, right—a series of Bourdon tubes, has a greater movement and accuracy

chamber in order that carbon can be wiped off regularly.

For convenience of operation, a rotary switch is mounted in the same case with the temperature indicator. Thus, an operator can stand in one location and read separately the temperature of each engine cylinder merely by turning a switch.

Inherent error of a deflection instrument is as much as one per cent of scale value. Over a range of 800 F this means a possible variation of 8 degrees. During the course of manufacture these instruments are calibrated for more exact readings at the operating temperature. If extreme accuracy is desired, a potentiometer type instrument should be used. This instrument costs approximately twice that of the millivoltmeter type, but its accuracy is within one-fifth of one per cent, which over the same scale range is 1.6 degrees.

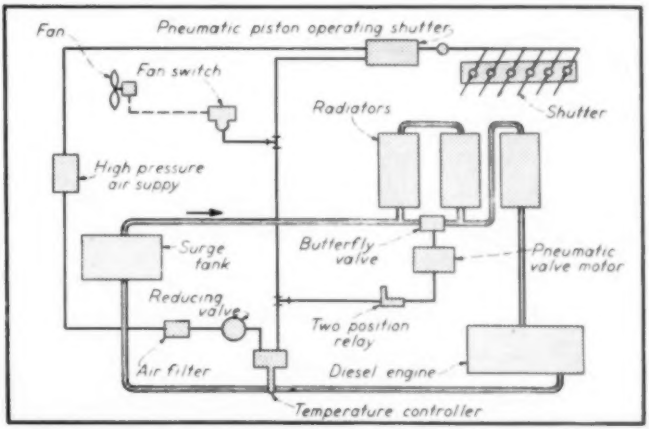
In order to determine if the cooling system is functioning properly, temperature measurement of cooling water both to and from the engine is required. Ordinarily, pressure-actuated thermometers of either the liquid-filled or vapor pressure type are installed. Both types consist of a bulb, connecting capillary tubing and spiral located in the instrument. As the temperature at the bulb increases, pressure is built up within the system and transmitted through the capillary tubing to the spiral, which tends to unwind and move the pointer upscale.

For remote indication at a central panelboard, connecting tubing between the bulb and instrument can be as long as 200 ft. By using pneumatic transmission, this distance can be increased up to 1000 ft in special cases.

In the vapor-pressure type thermometer, the system is partially filled with highly volatile liquid, the vapor pressure of which is proportional to the temperature being measured. An important feature of a thermometer of this type is that changes in ambient temperature along the capillary tubing and the spiral do not affect the accuracy of the instrument. A second important feature is the high speed of response. Slight changes in temperature causes quick changes in vapor pressure, that are transmitted.

Vapor pressure thermometers are affected by the head between the bulb and the instrument. If the instrument is located above the bulb and the tubing is filled with liquid, the instrument will not read the correct temperature but some lower temperature. Conversely, if the instrument is below the bulb, the instrument will read high. Therefore, with the line filled with liquid, thermometers must be corrected for bulb elevations above or below the instrument case.

Mercury-filled thermometers operate on the principle of the volumetric expansion of mercury with changes in temperature. In this class of thermometer, errors are introduced by changes in temperature along the capillary tubing and spiral. The ratio of volume in the bulb versus volume in capillary and spiral is therefore limited. For ac-



Typical control network for an engine jacket water cooling system. Controller can operate valves, fan or shutters to regulate temperature or circulated water

curate readings, both case and capillary compensation are required.

For remote indication up to 1000 ft, a resistance thermometer can also be employed. The measurement circuit consists of a Wheatstone bridge in which the thermometer forms one of the legs of the bridge. Resistance of the element, commonly made of coiled nickel, varies with temperature. With constant voltage supplied to the bridge, an output voltage is obtained that is proportional to the temperature surrounding the element. A deflection type galvanometer measures the output voltage and indicates temperature directly. For extreme accuracy, a potentiometer type instrument is utilized.

Lubricating oil temperatures to and from the engine and intake air temperatures are ordinarily measured and indicated by means of mercury or alcohol filled glass thermometers mounted directly on the engine. These temperatures can vary within reasonable limits without materially affecting the operation. A routine check once every one-half to one hour is quite sufficient.

Spiral pressure elements are essentially a series of Bourdon tubes joined end to end and wound as a flat spiral. As pressure is applied, the end movements of a number of such tubes are added, resulting in greater movement of the free end without need for amplification. Because of the increased accuracy, ample torque and over-range capacity spiral pressure elements are usually incorporated.

Pressure instruments are suitable for either direct mounting on the engine or for mounting at a remote location. In addition to indicating, a record of lubricating oil pressure and jacket water pressure for later analysis is used to advantage. Instruments with spiral actuating elements are available with recording facilities.

Fuel oil and circulating water flow must be considered. An integrating type flow meter will show the total quantity of fuel that has been consumed over any period of time. For fuel oil measurement, flow meters are installed between the storage and day tanks since flow from day tank to engine is too small to measure accurately.

Water flow is convenient to check since any plugging of water passages in the engine would be reflected in a decreased flow rate. Water flow together with pressure provide a means of determining the source of any malfunction in the cooling system.

In larger installations such as on pipeline pumping stations, lube oil temperatures are sometimes automatically recorded and controlled. Since glass thermometers are not suitable for such purposes, a thermometer such as a pressure actuated type is required.

Successful engine operation requires proper circulation of lube oil and jacket water as well as sufficient supply of fuel oil and air. Pressure measurement of these variables is a very reliable means of determining operating conditions. Low lube oil pressure very seriously affects the operation and should be corrected immediately.

Interruption of circulating water flow is indicated more promptly by pressure change than temperature change. Pressure in the air intake line is a means of checking the pressure drop through the intake air filters in order to determine the time when cleaning of the filters becomes necessary. In addition, pressure of fuel oil, starting air, injection air and scavenging air is required.

The Bourdon tube is the simplest and most common type of pressure measuring element. It is elliptical in cross-section and circular in form. One end of the tube is connected to the pressure source, and the other end is sealed by a plug and free to move. When pressure is applied, the tube tends to lose its elliptical cross section and become circular. This results in a movement of the free end outward, and its connected pointer moves across a scale. A sector and pinion amplifies the tube movement.

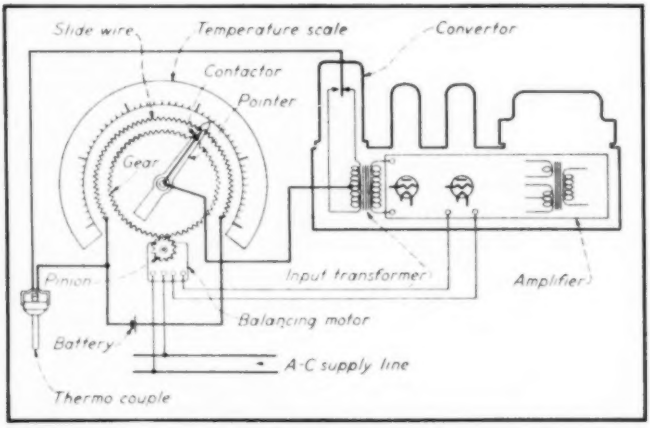
In addition to measurement and indication of operating variables, instruments also provide facilities for automatic control. In this capacity, they either regulate a particular variable such as engine water temperature, warn of dangerous operating conditions or stop the engine in the event of hazardous operating conditions.

Most diesel engines use an automatic system for control of engine jacket water temperature. Advantages of automatic control include more uniform cylinder temperatures, improved lubrication, less warm-up time and saving of operator's time.

A liquid-filled type temperature controller is inserted in the engine water discharge. The temperature controller by means of a lever system and pilot valve mechanism provides a regulated air output for control of shutters, fan and valve. Below the control temperature, shutters are closed, fan is off and by-pass valve is open permitting water to pass through only one radiator. At the control temperature, a pneumatic motor closes a butterfly valve, forcing the water to circulate through all three radiators. Above the control temperature a power piston opens the shutters an amount in proportion to the deviation from the control point. At the same time a pressure actuated switch starts the fan, which circulates air past the radiators.

Safety devices are available that function to stop the engine in the event of high jacket water temperature or low lube oil pressure. A non-indicating controller with both temperature and pressure sensing elements can close circuit contacts at whatever point that is considered dangerous.

Temperatures and pressure instruments can operate an alarm or light a lamp to show high jacket water temperature, high lube oil temperature, low lube oil pressure, low fuel oil level in day tanks or low air pressure in the starting air tanks. Usually a non-indicating instrument is usable except where suitable control facilities are already supplied by other instruments.



Potentiometer controlled engine cooling has the advantage of uniform cylinder temperatures, improved lubrication, shorter warm-up time and greater efficiency

IF GENERATORS MUST BE PARALLELED

CONNECTIONS for operation of generators in parallel for an appreciable time should follow recommended practices. However, when an emergency load requires more than one machine, time to obtain matched sets or to determine characteristics on available units is often lacking. Furthermore, separated locations may make equalizer ties undesirable.

Although efficiency and good voltage regulation are sacrificed, either a shunt or a compound generator may be operated with another of different type or characteristics (but with approximately the same voltage) providing regulation at the point of connection is made so poor that each "shirks the load." Simplest method is use of a ballast resistor, Fig. 1, in each circuit.

Effect of resistance is illustrated in Fig. 2. Machine *A* may have some load characteristic (as yet unknown) such as *A* and generator *B* another curve *B*. Corresponding voltage drops in each resistor will follow curves RIa and RIb as the load varies. Resultant load characteristics, **A′** and **B′**, for each generator and resistance combination will be the difference between the load curves for machine and resistor.

Were it not for the resistor, voltage of a machine with a rising curve such as *B* would increase when any system change, such as reduced speed for generator *A*, added more of the line load.

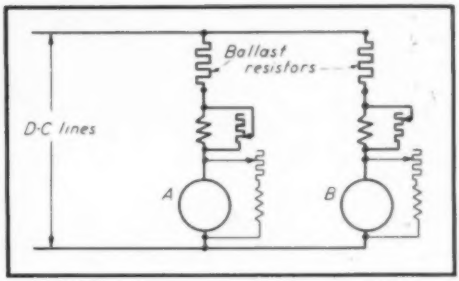


Fig. 1 — Ballast resistors avoid need of closely matched load characteristics under emergency conditions requiring paralleling

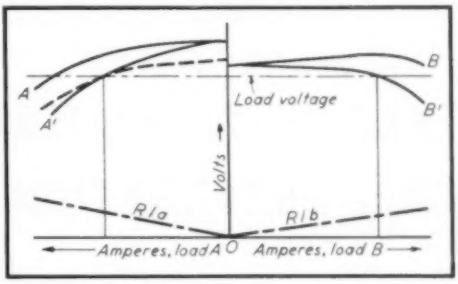


Fig. 2 — RI drops subtract from terminal voltage of machines to insure drooping characteristics that prevent "hogging" the load. The resistors also act as buffers to limit circulating and inrush currents, always a possibility in temporary circuits

The rising voltage, of course, would cause machine B to "hog" the load.

Curve *A*, Fig. 2, is shown as a drooping characteristic typical of shunt wound or severely undercompounded machines. *Where it is certain* that the machine has this type of curve, little or no resistance would be necessary. The voltage could then be adjusted to bring the load curve down to the dotted line to cross the load voltage level at the desired current.

Resistors which will give about 10% voltage drop will usually be adequate to make any normal generator curve droop. After trial under load, this value may often be reduced.

It should be noted that in temporary and "cobbled-up" installations, the ballasts also act as buffers to limit current peaks and inrushes. Machines with a much greater variance in voltage can be connected together and the load adjusted with the aid of an ammeter only (the clamp-on type is convenient because circulating currents are limited. Other factors, such as changes in speed, are correspondingly less serious.

Value of the resistor is easily found by Ohm's law. For example, if a 250-v machine is to supply 200 amp at a 10%, or 25-v, drop, the resistance equals drop divided by current or .125 ohm. Ordinarily, any value between .10 and .15 ohm would be satisfactory.

Heat dissipating capacity of the resistors must be adequate. Cast iron grid or edge wound ribbon resistors employed in d-c motor starters and wound-rotor induction motor controls are often on hand, either alone or in the complete control unit. Ratings are frequently available on such units, or can be calculated from previous service. However, where ratings based on intermittant duty are used, currents must be reduced for continuous duty.

Improvised resistors for medium loads might consist of steel wire wound on wooden frames, and if necessary, immersed in running water. A water rheostat may be made by dipping two conducting plates in a salt solution in an insulated tank. Immersed plate area should be great enough to keep the current density below one amp per sq in. Voltage drop is about .2 v per in. of distance between plates, for a 5% solution by weight, increasing to .3 for a 10% solution. Since the water will boil away, increasing the concentration, the level must be maintained. This type permits the generator to be gradually brought onto the line by slowly lowering the plates into the solution.

Resistor types using liquid are safe *only* on low voltage and then *only* if complete precautions are taken to isolate personnel and nearby equipment from the associated fumes (from the salt bath) and moisture.

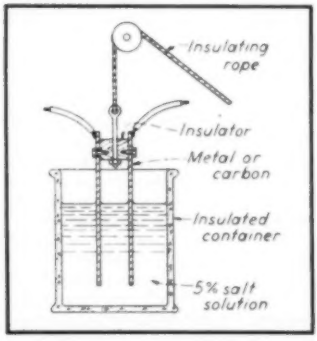
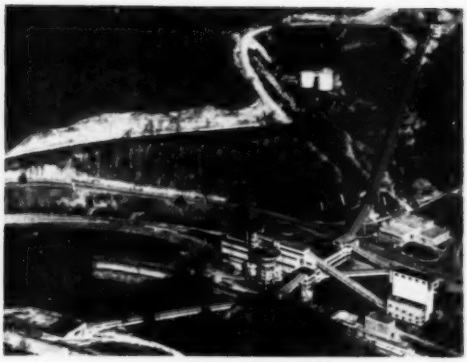


Fig. 3—Water rheostat is obsolete but good in pinch. Watch fumes, insulation



Preparation station is nestled in the valley, and the coal mined in the mountain is delivered to it by belt conveyer

Run-of-mine bituminous coal moves down the mountain side at a rate of 750 ton per hr. Wide aisle aids in maintenance

INLAND STEEL HAS SUPER COAL PREPARATION STATION

This company's coal preparation plant, recently placed into operation, has reduced the ash content from 7 to 3 per cent. Run-of-mine coal is handled at the rate of 750 ton per hr down a mountain side

INLAND STEEL CO., placed into operation a new coal preparation plant at Price, Kentucky, to reduce cost and increase production of pig iron without the erection of new steel-making facilities. This coal cleaning plant will make possible a reduction in ash content of Inland's metallurgical coal from 7 to 3 per cent.

Called "the most completely engineered plant in the country," it contains advanced equipment for efficient preparation of run-of-mine bituminous coal for metallurgical use. Designed and built by Link-Belt Co., the overall capacity is 750 ton of raw coal an hour. Slate, rock, fire clay and other impurities are mechanically removed. An elaborate system of blending bins, paddle mills and conveyer systems permits automatic mixing of sizes and analyses for delivery direct to railroad cars.

By extracting coal in fault areas, which could not previously be mined at favorable costs, Inland not only is increasing ton-per-man production of coal, but is recovering a larger percentage of the total coal deposit before withdrawing from an area.

The coal washing plant reduces the ash content of the coal, and as a result, these important advantages will follow when used in blast furnaces in the manufacture of pig iron: (1) freight saving, (2) 30 per cent decrease in coke ash, (3) by-product production up, (4) blast furnace operation improved, (5) iron production increased and (6) open hearth capacity increased.

Plans for construction of a new central coal preparation plant began to take shape in 1946 after Inland had increased its holdings in the Elkhorn No. 3 Seam to approximately 30,000 acres. The newly acquired acreage lies north of the old property, 3,300 acres adjoin the Wheelwright Mine and 7, 400 acres are across Left Beaver Creek.

It was necessary to build a 4½-mile haulage tunnel to connect the Wheelwright and Price Mines and the preparation plant. Four passing sidings, each approximately 1500 ft long, were constructed equally spaced through the haulage road.

Consideration was given to both track and belt haulage, but track haulage from an underground assembly yard was finally decided upon. In addition to assembling the loaded cars in preparation for their trip to the Price Mine headhouse, the empty cars returning from Price are made up in a yard and allocated to the working sections of the Wheelwright Mine. A dispatcher controls the movement of trips, as well as scheduling the cars. Motormen receive instructions by means of trolley phones or telephones, and while moving have the safeguard of automatic block signaling systems.

The plant is designed to handle and prepare run-of-mine bituminous, containing lumps up to 24x24x24 in. in size, at the rate of 750 tph. Coal will all be received through the West Portal of the company's mine at Price, or by railroad or truck. The Chesapeake and Ohio Railway Co. has established milling-in-transit rates under which coal will move to the plant.

Planned for Future

Modern in every respect, it has been designed to take care of every contingency that may arise in the foreseeable future. For example, provision is made to permit future installation of an East headhouse at a later date.

Briefly stated, the plant is prepared to load into railroad cars: (1) plus 5 lump, (2) 5 x 3 egg, (3) 1¼ x 3/8 stoker and (4) 2 x 0 slack, to which may be added 1½ ring size, stoker, lump or egg.

Link-Belt Model 6044-E air pulsated wash boxes have been installed for cleaning 5 x 3/8 coal, and Deister diagonal deck washing tables for cleaning 3/8 x 0 coal. It was decided for economic as well as technical reasons to reduce moisture in the washed coal mechanically rather than by thermal drying. Therefore, Bird centrifugal filters are employed to dewater the washed 3/8 x 0 coal and dewatering screens for the 5 x 3/8 coal.

Mechanical handling of coal starts at the Price Mine headhouse high on the

mountainside, with a mine car-feeder ahead of a two-car rotary pump. This feeder is designed to handle a trip of 75 loaded 3-ton capacity mine cars, of which not more than 20 will contain mine rock. As the cars are advanced by the dump operator, they are weighed at the track scale and then dumped two at a time without uncoupling. Motor-operated gates under the dumper enable the load to be dumped either in the coal hopper or rock hopper without regard to the position of the car in the trip, and without delay in the dumping cycle.

Mine rock is fed by a reciprocating feeder from the rock dump hopper to a belt conveyer and discharged to a crusher for reduction to about minus 6 in. Belt conveyers lower the crushed rock down the mountainside, where the preparation plant is located, then across the valley. Here rejects from the coal washery join it, and they move up the opposite mountainside to a bin for disposal in a gob pile.

An emergency large bin is provided at the preparation plant for overflow of rock and refuse. Mine rock can be handled at a normal uniform rate of 125 tph, or up to 250 tph for short periods when an abnormal amount of mine rock is encountered in a single trip of cars from the mine.

Run-of-mine coal, after being rotary-dumped into the coal hopper, passes by reciprocating feeder to a belt conveyer and is carried to a combination screen and picking table and another belt conveyer. Large rock is handpicked from the coal while being carried down the mountainside to the coal preparation building. The run-of-mine coal is then separated into plus 5 (lump) and minus 5 in. sizes.

Handling Foreign Coal

Coal received from other mines by rail or truck, so-called "foreign" coal, is discharged into a dump hopper equipped with a reciprocating feeder, which delivers to a belt conveyer for discharge to the run-of-mine shaker screens. A car shaker facilitates the unloading of rail cars.

Lump coal passes from the sizing screens over a picking table. Here objectionable material containing reclaimable coal is removed together with small rock. This rock is delivered by chute to a rock crusher. The pickings removed for reclamation are crushed and fed back into the minus 5 in. coal coming from the shaker screen.

Picked lump coal is delivered directly to rail cars, and a loading boom equipped with a hinged end permits laying the coal gently in the car. An automatic changing chute permits cars to be changed without interrupting the flow of coal. A portion of the lump coal may be diverted and crushed. The crushed product is delivered to a mixer where it joins the natural 2 in. slack for loading into railroad cars.

Individual cars are weighed as they are being fed into the car dumper. The loaded cars are dumped two at a time without being uncoupled. Control panel for trip feeder and dumper can be operated by one attendant

Minus 5 in. coal is carried from the run-of-mine shaker screen to a five compartment blending bin. It is evenly distributed by means of a motor propelled automatic-reversing steel tank-type tripper equipped with a two-way discharge chute. Automatic controls signal the operator when the bin is filled to capacity, or when the coal has reached its lowest operating level.

Raw minus 5 in. coal is fed uniformly from five compartments of the blending bin by means of five belt feeders to five vibrating screens. Variable speed drives on the belt feeders permit regulation of feed rate.

The 5 x 3/8 in. coal is delivered by belt conveyer to a shaking chute, which delivers equal portions to each of two air-pulsated wash boxes. The stream of raw coal passes over a perforated plate and is subjected to the action of periodic upward and downward currents of water. This action causes stratification of the coal and impurities according to their respective specific gravities. The lower specific gravity clean coal concentrates in the upper strata while the heavier impurities—clay, rock and slate—accumulate in the lower strata. The upward water current raises the coal over a weir while the impurities are trapped.

Primary refuse is carried by a conveyer system to special bins. Secondary refuse is rescreened at about 2 in. The under-size is carried away for disposal while the oversize is crushed and delivered to the blending bin with the 5 x 0 in. coal. Fines are washed through the screen onto an endless screw.

Washed and cleaned coal, from the wash boxes, is sluiced to the washed coal screens, on which the coal is separated into four sizes: 5 x 2, 2 x 1¼, 1¼ x 3/8, and minus ⅜ in. 5 x 2 in. coal can be delivered directly into railroad cars for shipment. A portion or all of it can be diverted by apron conveyer to a crusher and delivered to a paddle mixer to join natural 2 in. slack for loading into cars.

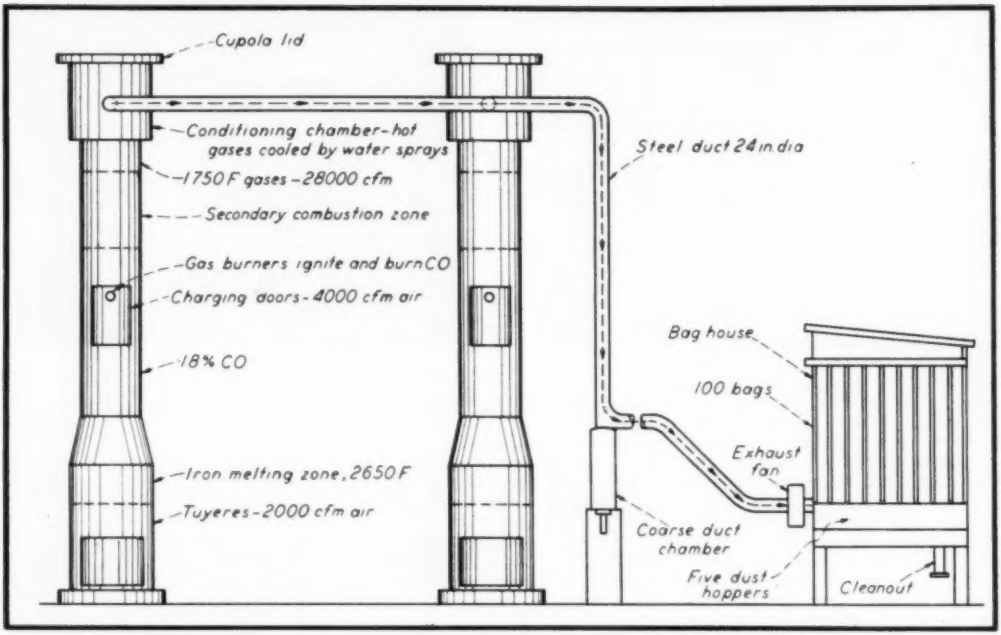
Stoker coal is delivered from the washed coal screens to a secondary dewatering screen and discharged to a reversible belt conveyer for delivery to the car loading boom. Minus ⅜ in. coal, which passes through the washed coal screens, is pumped to a settling cone. Settled solids are pumped to the effluent from the concentrating tables before delivery to centrifugal filters.

Cleaning coarse coal is not a particular problem. But, present mining methods produce a large precentage of minus ⅜ coal, and this presents a major cleaning problem. Minus 3/8 in. coal from five vibrating screens at the blending bins is collected by belt conveyer and delivered into a surge bin. It is fed into a Sidekar-Karrier, distributed to hoppers at a constant rate and to diagonal deck washing tables.

Clean coal from the washing or concentrating tables is collected in sluices and delivered to five centrifugal filters for dewatering. These dryers are built around a horizontal shaft and consists of two rotating elements. The outer is a solid bowl shaped like a truncated cone. This rotates at 650 rpm and develops a force many times that of gravity. Inside this bowl, and turning at a slightly different speed, is a helical conveyer. The centrifugal force compels even the finest solids to settle.

Resultant coal, which falls well within the required moisture limits, is conveyed by belt to a slack belt for transfer to the paddle mixer and subsequent loading into cars. Refuse from the concentrating tables is dewatered in a centrifugal filter and then conveyed away by the refuse belt for disposal with the wash box refuse.

The water system provides maximum washing capacity with the minimum of water clarifying equipment.



Air, at a rate of 2,000 cfm, is discharged into the iron melting zone and rises through the combustion chamber where is mixes with 4,000 cfm of secondary air. The air expands to 28,000 cfm at a 1,750 F temperature

SMOG IS LITERALLY IN 'THE BAG' AS IT MEETS UP WITH THESE COLLECTORS

Here are summarized facts that tell of the manner in which a Los Angeles foundry whipped the smog problem. Furnaces installed originally to permit 50 lb of fly-ash to escape per hour now are harnessed to baghouse collectors and the discharge is now only 10 lb

IRRITATING SMOKE from foundry furnaces, long and contributing factor to air-polluting smog, has been successfully curbed for the first time, after more than a year and a half of special research, at the Los Angeles plant of General Metals Corp.

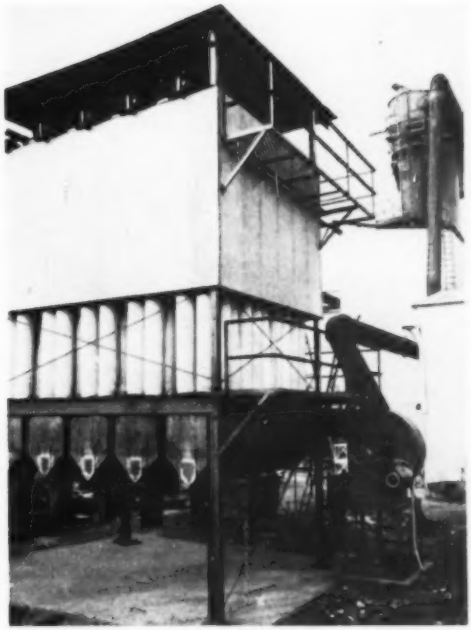
Sidetracking some 450 lb of solid material, which otherwise would be added to the general air pollution each day, has been the tedious and difficult task of the Whiting Corp. engineers working in conjunction with General Metals personnel.

Foundry furnaces were built by Whiting that were smog controlled and geared to Los Angeles regulations. But, normal volume and composition of the foundry smog fell short of new regulations imposed by L. A. subsequent to the letting of the contract. Allowable emissions of dust and fume, under the regulations existing before installing the furnaces, was approximately 50 lb per hr. The drastic new requirements reduced this to less than 10 lb per hr.

When the furnaces were installed and tested, they did not meet the new stringently increased recent demands for control. Whiting engineers determined to meet the new requirements, and, in doing this, to beat the smoke pollution problem with equipment, which would become standard wherever control of high temperature smog was demanded of industry

At a cost of about $100,000 and a long series of experiments in laboratory and in pilot model work, the highly effective baghouse eliminator was contrived. Emissions from the furnaces, in the condition at which they reach the baghouse, are loaded with particles found to be approximately 50 per cent silicate oxide, 30 per cent iron oxide and about 20 per cent lime, manganese and sodium

Baghouse is a multiple of long cloth dust collectors hung from an I-beam sub-structure. Bins are emptied with trucks



Overall picture of cupola, in background, and baghouse. Suction fan removes smoke by means of the 2-ft dia, 60-ft duct

oxide. The baghouse collects 50 lb of these particles each hour of the cupola operation. The collection coming from accumulation hoppers in the baghouse has the appearance of finely powdered milk chocolate. Complete success of the baghouse has been determined by a test run, starting early in December.

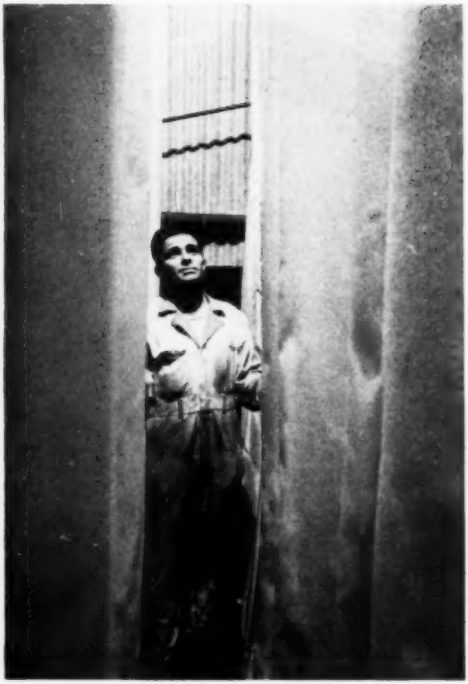
Potential smog at this large foundry now ends up, literally, "in the bag", being ingeniously syphoned away before release to the atmosphere by means of a unique glass baghouse.

Operation of the baghouse is described as like that of the "modern vacuum cleaner principle". To fit this principle to the high temperature problem encountered in furnace conditions, the use of fiber glass bags, silicone impregnated, was decided upon. The porous bags withstand temperatures up to 750 F. The smog at General Metals is 650 F when it passes into these bags.

Primary requirement of the equipment is the filtering out of fine-grained metallurgical fume emitted from the furnaces. This fume evades the principles of standard spark and fly-ash suppressors. After many tests the baghouse was engineered, meeting all requirements. In fact it captures particles about the same size as are found in cigarette smoke. In all, the baghouse isolates about 50 lb per hr of these minute components.

Hot gases, rich in explosive carbon monoxide, are burned in a secondary combustion chamber between the furnace charging door and the stack top. Smog from the furnaces first passes through a wet scrubbing stage at stack level. This wet scrubbing eliminates about 30 per cent of the coarse particles

William O. Jenkins, of Whiting, inspects solidified smog taken from accumulation hoppers with Gordon W. Larsen (left) the director of Los Angeles smog control



Smoke laden air, at the rate of 13,000 cfm, is handled by these fiber-glass bags. Each bag is 15-ft in height and is one foot in diameter. Particles, the size contained in cigarette smoke, are retained on the surface of this cloth

from the furnace emissions and cools the hot gases from 1700 F to approximately 1000 F.

Smog passes from this "hydro-clone" area through a two-foot diameter steel duct. While passing through this 60-ft duct, temperature is reduced to 500-650 F by radiation. A blower in the baghouse sucks the furnace smog through the duct into 100 fiber glass bags, each 15-ft high and 12 in. in dia. Each bag acts as a vacuum filter, capturing these minute particles. The baghouse handles about 13,000 cubic feet of smoke per minute under regulated temperature conditions.

Los Angeles' smog problem is attributed by experts to the fact that there is approximately six times as much smoke-producing industry in the city as there was ten years ago. Also, a large amount of smog is produced by automobiles, which in Los Angeles consume some 3,000,000 gal of gasoline daily. Home incinerators and smudge pots also account for major contributions to the problem, and they are now under consideration.

This is the combination that has worried Los Angeles. The smog hits the resort life, worries the tourist croppers, endangers health and irritates the eyes. Within the past few years war has been declared on smog by the Los Angeles County Air Pollution Control District. The organization ferrets out violators, commands abatement, issues permits to conforming applicants and generally makes war on smoke creators.

Four phases of the District's activities embrace inspection, enforcement, research and engineering on air pollution cause and problem. Working against all known pollutants—and there are many—the District claims a 30 per cent improvement in a little more than two years as of July 1950. In the Los Angeles Basin both meteorological and topographical conditions cause the contaminants to accumulate. Low wind velocities and a surrounding crescent of mountains on three sides cause a temperature inversion above the basin. All these factors indicate that there must be more stringent regulations than elsewhere with more efficient equipment to filter smog particles out of industrial smoke.

The Cover Illustration—Gas-Engine Compressors on Big Inch lines

● Vital in assuring a constant supply of natural gas to the New York area are pipe line compressor stations like Texas Eastern Transmission Corporation's Hope, Ark., station shown on this month's cover. This station contains eight Cooper-Bessemer Type GMV two-cycle gas-engine compressor units developing a total of 8,300 compressor horsepower.

Texas Eastern Transmission Corporation's pipe lines, which extend from the producing field of Texas to New York, are known as the Big and Little Inch lines. These lines were built by the Government during World War II for the transmission of oil to the east coast and were subsequently sold to Texas Eastern for natural gas transmission. The 1,340 mile Big Inch line was laid from Longview, Texas, to the eastern seaboard while the Little Big Inch line originated at Beaumont, Texas, and terminated at the New York area; a total length of 1,475 miles. The original volume of natural gas transmitted through these oil lines was approximately 140,000,000 cu ft daily. The daily volume has been increased, through the addition of compressor horsepower, to many times this amount.

Recent developments by The Cooper-Bessemer Corporation, one of the leading gas engine and compressor manufacturers, have made it possible to supercharge the GMV compressor unit, which means 18 per cent more horsepower in the same space. The supercharged rating is 135 hp per cylinder as against the previous turboflow rating of 110 hp per cylinder.

CENTRIFUGAL PUMPS — TYPES AND SUB-DIVISIONS

To help you get the best pump* for each particular job, the authors explain the various classifications and discuss the types available. Future articles will cover every phase of pump application from basic fundamentals of selection to problems encountered in installaltion

IGOR J. KARASSIK and ROY CARTER,
Application Engineers
Worthington Pump And Machinery Corporation

NATURE, in evolving the higher animals, first had to invent pumps to circulate blood and to pump air in and out of the body. Likewise, man had to invent pumps before he made much progress in developing civilization.

The principles on which these various types of pumps operate are: (1) lifting by buckets, (2) drawing by creating a vacuum or (3) forcing by pressure, or a combination. In the first group could be classed the sweep, the windlass—buckets on a revolving wheel—the chain and bucket pump and Archimedean screw, all still in use. In the second group come the injectors, siphons or eductors and, combined with the first or third, most of the hand pumps like the pitcher pump. In the third group fall the force pump, the various rotary types, most of the reciprocating designs, devices using compressed air and the centrifugal types.

Commercially, in what could be called modern pumping machinery, we find a number of types of pumps being used. Without attempting to classify their operation by principle we have: (1) the air chamber type, (2) injectors, (3) siphons and eductors, (4) rotary pumps, (5) reciprocating pumps, (6) regenerative pumps, and (7) centrifugal pumps.

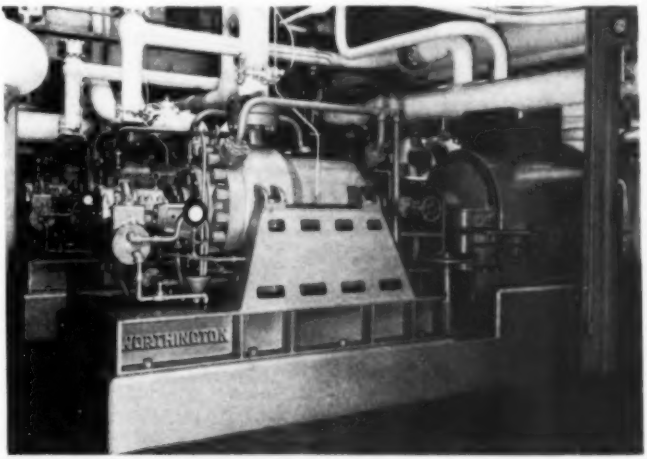
In the air-chamber type liquid flows by gravity into a closed tank, which is vented to atmosphere during the filling period. When the tank is filled, the inlet and vent valve close and, after a valve in the discharge line opens, air under pressure is admitted to the vessel forcing the liquid out of the tank. This pumping device with automatic controls is still a commercial product and is frequently used in the basement of buildings below sewer level for collection and pumpage of sewage and other waste waters. A similar device called the Pulsameter, employing steam as a motive power and a duplex tank arrangement, was often used in mines.

Injectors were very commonly employed to add water to steam boilers, particularly on locomotives. In an injector, steam is expanded through a nozzle attaining a high velocity as it enters a chamber open to the water to be pumped. As this jet picks up water, the steam is condensed and the resulting high velocity stream of water, which is partly condensed steam, has enough energy to carry it into the boiler. Naturally, energy to inject the water comes from condensing steam.

The siphon and eductor types of pumps can use steam, a compressed gas, or liquid as a source of energy. In a water-jet eductor, the power water flows through a nozzle producing a high-velocity jet directed into a throat piece. The jet action carries along first, any pocketed air, and then the liquid to be pumped. The discharge nozzle of the throat piece is tapered so the resulting high-velocity stream is slowed down and the velocity energy converted to pressure energy. In the steam-jet siphon the action is similar, but the actuating means is steam expanded in a nozzle. Like in the injector, the steam is condensed by the water being pumped. When the source of energy is compressed air or other gas, the discharge is a liquid and gas mixture.

The head in feet against which a steam-jet siphon can operate is roughly equal to the available steam pressure in psi. In regular materials they are commercially available in sizes from ½ to 12 in. (suction and discharge) handling from 3 to 1,600 gpm. With a steam-jet siphon, the liquid being pumped is naturally heated somewhat and diluted by the steam condensed. Either of these results may prevent the use of steam-jet siphon. In addition to being made of regular materials, steam-jet siphons have been made of glass in the smaller sizes, and of stainless steel, and other materials for specific services.

The head against which a water-jet eductor will operate is roughly one-fifth the supply pressure. They are commercially available in regular materials in sizes up to 24 in. Of recent years, small-capacity well-pumping



Today's high-pressure pump (1,300 psi and above) uses a casing split radially for strength and structural considerations. Internal barrel encloses impellers

* This article will be included in a book on centrifugal pumps now being prepared by the authors; hence all rights to republication are reserved by them.

equipment using a centrifugal pump and water-jet eductor has become quite popular for farms and other domestic-water systems. The pump, located above ground, forces part of its capacity down one pipe into the eductor, which forces a larger combined capacity up a second pipe into the suction of the pump.

The rotary pump, of which the gear pump is possibly the most common type, is extensively used for relatively small capacities. It is especially applicable for many viscous liquids.

The reciprocating pump is well known, particularly the duplex direct-acting steam pump. Various types of liquid ends are used—piston, plunger and diaphragm—some designs being single acting while others are double acting. Pumps may be made as single, duplex, triplex or more combinations of water-end elements. The power source may be direct as in direct-acting steam pumps, through a crank and flywheel or from some other form of prime mover either direct or through belting or gearing.

Regenerative Unit

The regenerative-type pump is often grouped with the centrifugal type. It is an interesting design and very useful and efficient for handling small capacities of low-viscosity liquids. While it utilizes centrifugal force to generate pressure, the liquid is only acted upon by the periphery of the rotating element, and the path of the liquid is from one point on the periphery to another point almost 360 deg. away. In a centrifugal pump, on the other hand, liquid enters the impeller near the shaft and leaves at the periphery.

The centrifugal pump was originally employed as a large-volume low-head machine, but has now become the most important pumping machine. Reduced to its basic function and fundamental parts, a centrifugal pump is a machine consisting of a set of rotating vanes, enclosed within a housing or casing, and used to impart energy to a fluid through centrifugal force. Thus, stripped of all refinements, a centrifugal pump has a rotating element, impeller and shaft, and a stationary element made up of casing, stuffing box and bearings. These parts will be described in future articles.

Wide Application

Among the factors which contributed to the growing use of centrifugal pumps, one of the most important has been the development of electric power. This century has seen the widespread adoption of electricity as the main source of power for most applications, replacing the small steam plants, which formerly were so common. The various types of reciprocating pumps were ideal for steam drive, but the development of the electric motor allowed the use of the lighter and cheaper, direct-connected centrifugal pump. While these earlier centrifugal pumps were inefficient compared to modern performance standards, this inefficiency was more than offset by their lower first cost.

In addition, the centrifugal pump immediately demonstrated that it possessed quite a few other advantages over the reciprocating pump, which led to a constantly growing application of the newer type of pumping equipment. For example, the centrifugal pump gives a steady flow at uniform pressure and without pressure surges. It develops a limited maximum discharge pressure under any operating conditions and provides the greatest possible flexibility of operation, because its delivery may be controlled either by variation of speed, or by throttling.

Modern centrifugal pumps can be divided into various types. The basic subdivision concerns the impeller itself, specifically with regard to direction of flow in it. Thus, centrifugal pumps may have radial-, axial-, or mixed-flow impellers—a combination of the first two. Insofar as the impellers are concerned, they further may be (1) enclosed (with shrouds or side walls enclosing the vanes), (2) open, or (3) semi-enclosed.

Water Entrance

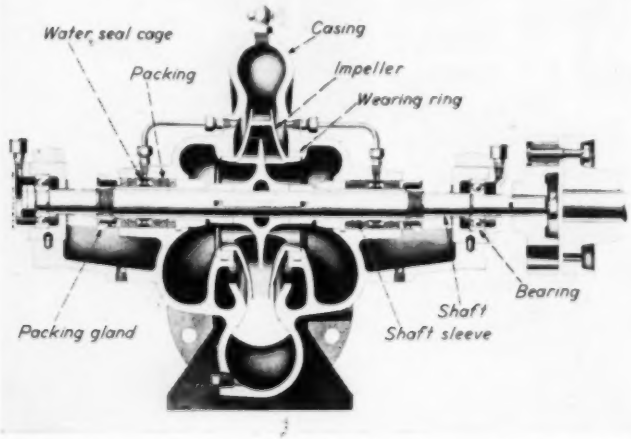
Another subdivision of types concerns the question of water supply to the impellers. Thus, impellers may be (1) double-suction (with water flowing to the impeller symmetrically from both sides) or, (2) single-suction, (with a single inlet on one side). Subdivision of centrifugal pumps on the basis of casing type yields two major groups: (1) volute-casing pumps, and (2) turbine, or diffuser-type pumps. In either case the casing may be split axially or radially for easy inspection.

A centrifugal pump, in which the total head is developed by a single impeller, is termed a "single-stage" pump. If the total head required is too high to be generated by a single impeller within practical limitations, two or more impellers (or pumps) may be used in series, the second impeller taking its suction from the discharge of the first, etc. If all impellers acting in series are located within a single casing, the centrifugal unit so constructed is a multi-stage pump.

Application Features

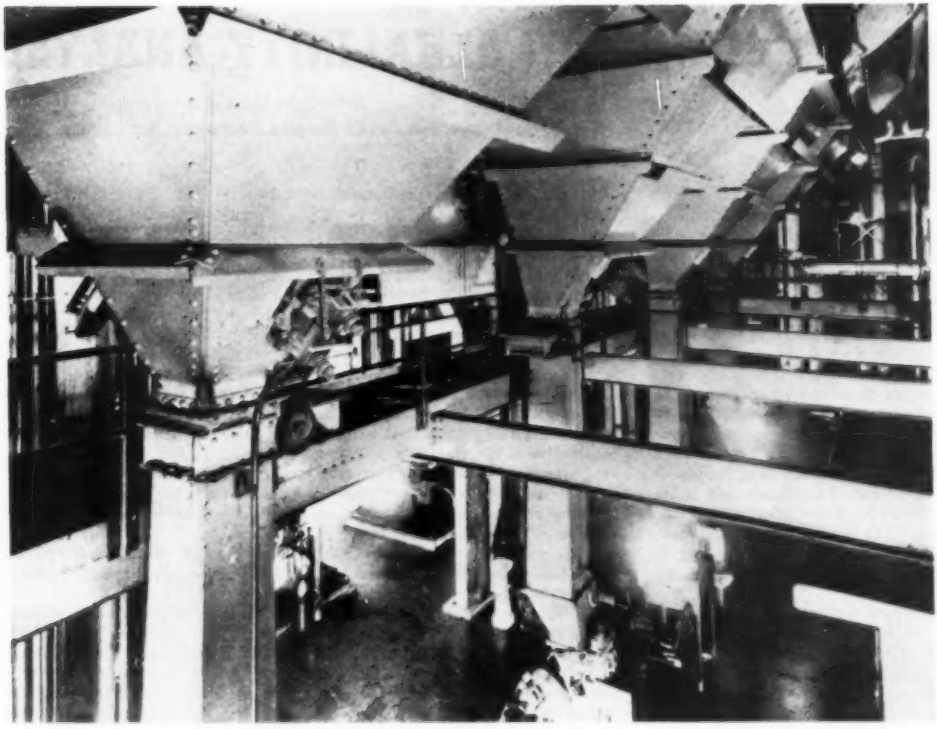
In the early development of centrifugal pumps, bi-rotor and even tri-rotor units were fairly common. These were, in effect, two half-capacity or three one-third-capacity pumps built into one casing and operating in parallel.

Centrifugal pumps may be either horizontal or vertical, in reference to the axis of rotation of the shaft. In some specific applications, the axis of rotation may be inclined to the horizontal—as in dewatering pumps in inclined mines. Horizontal-shaft centrifugal pumps are also classified with respect to location of the suction nozzle, and may be: (1) end suction, (2) side suction, (3) bottom suction, or (4) top suction.



Double-suction centrifugal pump with keyed shaft sleeves and liquid seal lines to the packing glands. Wearing rings restrict flow from discharge to suction

KEEPS COAL BUNKERS' NOSES CLEAN



To resist wear and corrosion from sulfuric acid, these bunkers have bottoms and noses of Monel clad steel

LEONARD W. WILLIAMS, *Manager Technical Services, Lukens Steel Co.*

PREVENTION of "rat-holing" and arching of bunker stocks, known to be the chief causes of dangerous, raw-coal feed interruptions, has now been achieved by the development of a novel design in modern coal-handling equipment.

Though much had been accomplished earlier by radical modification of conventional bunker design, with walls so spaced that potential arches and "rat-holes" became self-destructive in the stack or "pile", the bottoms and noses, being necessarily restricted as to dimension and location, have up to the present limited major modifications. Yet, it is here that the packing of coal dust, in surface pits caused by abrasion and chemical attack, most often starts a block build-up leading to arching. This is particularly true where fine or pulverized moist bituminous coals are used. Generally higher in sulfur content than other types, this coal tends to form a corrosive concentration of sulfurous acid. This intensifies any pitting condition, which may have resulted from the calcium chloride treatment given this coal to reduce dust and prevent freezing.

A solution to these problems was recently developed during the planning of a new 60,000-kw plant at Holland, N. J., for the New Jersey Power and Light Company. It combines the best features of design and material in the construction of a 1,400-ton bunker feed to handle daily 550 tons of ¾ to 1-½ in. graded bituminous coal for its four-pulverizer installation. The noses, including the lower 5 ft of each compartment, designed to an optimum angular pitch, were fabricated of Monel-Clad steel. The abrasion and pitting resistance of the inner monel surface, which has necessary structural strength from the steel backing plate, prevents compacting of coal dust under varying loads from full to empty and makes the bunker self-cleaning. Stand-by vibrators and air-jets were installed as normal safety precautions.

Since this installation, savings in operating costs alone have practically cancelled out the cost differential of the materials used. Also, the smooth work-hardening properties of the monel surfaces have prevented "gouging", minimized pitting and greatly improved operating conditions of the noses. Net effect on production has been increased service life expectancy with a high safety factor because risk of explosion, due to feed failure, has been all but completely eliminated from this coal handling operation.

When computing the various forms of alkalinity found in boiler water you must take phosphates into consideration if you expect accurate results when —

INTERPRETING AN ALKALINITY ANALYSIS

S. L. TERRY, *Engineer, Southwestern Public Service Company*

WHEN THE GENERAL theories dealing with alkalinity and its analysis are thoroughly understood, a very important factor in water treatment can be kept under control. Observing the variation of this test sometimes aids in locating trouble points in a system before serious damage can occur from scale deposits. Proper control of system alkalinities is also very important in preventing corrosion. The usual practice, therefore, is to rely on titration tests to determine the degree and types of alkalinity present in a boiler. A fifty milli-liter sample is measured into a titration vessel and a few drops of phenolphthalein indicator added. The sample should turn pink. If it does not, the pH is below 8.3, and the water is not considered safe for a boiler.

The pink indicates that carbonates and, or, hydroxides are present. N/50 (0.02N) sulfuric acid is then added to the sample until the pink coloration just disappears. This is known as the phenolphthalein end point and occurs at a pH of 8.3. The ml of N/50 acid used is multiplied by 20, and this figure is taken as the phenolphthalein alkalinity, often referred to as the "P" alkalinity.

A few drops of methyl orange are then added to the same sample, and if the sample is straw colored, the titration is continued until the first permanent tinge of a salmon pink is noted. The total ml of N/50 acid used in the phenolphthalein and methyl - orange titration are then multiplied by 20, and this figure becomes the methyl-orange alkalinity; sometimes shortened to "M" alkalinity. If a pink color developes when the methyl orange is added, the "M" alkalinity is the same as the "P" alkalinity.

Since alkalinity in boiler water is usually due to the carbonates, hydroxides, and phosphates of calcium, magnesium, and sodium, it is not possible to find exactly what material to report. As a result, it is the accepted practice to give results in calcium carbonate, which has a molecular weight of 100.

Back we come to the sample of boiler water and to the "P" and "M" alkalinity. In titrating the sample to a "P" end point it is said that reaction has taken place with all the hydroxides and one-half the carbonates. The other half of the carbonates are reached within the titration to the "M" end point, which occurs at a pH of 4.3. Since bicarbonates are decomposed by temperatures found in steam boilers, (reference equation 1) they may be assumed to be absent.

Table 1 shows that when "P" is less than ½ "M" the carbonates and hydroxides are equal to so and so. It is used occasionally in lining out a soda-lime softener or in studying various kinds of water for analytical purposes, but it is of very little use when considering boiler water.

Phosphates are usually present in a boiler and they react to cause alkalinity. This upsets the values in Table 1 because they are only approximately correct to start with.

One of the significant reasons for controlling the alkalinity of a boiler is to assure a high-pH water. Iron does not dissolve in water when the pH is above 9.6, and when oxygen is absent. When the "P" alkalinity is over one-half the "M" alkalinity, the pH of the boiler water will be near or above this figure.

Another step in alkalinity control is set so that phosphate will react with residual hardness coming into the boiler from evaporator carryover, condenser leaks, and zeolite softeners. It has been found that an "M" alkalinity of 200 ppm or over is necessary for this reaction to complete itself at boiler pressures below 600 psi.

When total solids in a boiler get near the upper limits, Table 2, as set by the ASME Boiler Code, boiler manufacturers state in their guarantee

Knowing how to interpret boiler-water tests is of no advantage unless they are performed properly. Well-equipped

laboratories like these — East Plant left, and Riverview Plant right — provide equipment needed for accurate work

TABLE 1—COMPUTING VARIOUS FORMS OF ALKALINITY

Result of Test	Hydroxide	Carbonate	Bicarbonate
P = O	O	O	M
P < ½M	O	2P	M-2P
P = ½M	O	2P	O
P > ½M	2P-M	2(M-P)	O
P = M	M	O	O

Note: All figures are ppm as calcium carbonate.

TABLE 2—MAXIMUM T.S. IN BOILER WATER

(A S M E Code)

Psig	Ppm
0-300	3,500
301-450	3,000
451-600	2,500
601-750	2,000
751-900	1,500
901-1,000	1,250
1,001-1,500	1,000

for steam purity that the "M" alkalinity must not exceed 20% of the total solids. When the total solids are held much lower than the ASME maximums the "M" alkalinity can be carried higher than 20% without danger of priming.

For example, Denver City Plant carries 600 ppm total solids in their 450-psi boilers and the "M" alkalinity averages about 40% of this figure. They have not had priming, nor has Moore County Plant with 2000 ppm total solids and "M" alkalinity of 600 to 700 ppm.

There are, then, three control points for alkalinity in a boiler:

1. The "P" alkalinity must be greater than one-half the "M" alkalinity to maintain a minimum pH of 9.6 in a steaming boiler (pH of 10.5 in a sample at room temperature); this helps prevent corrosion.

2. A minimum of 200 ppm "M" alkalinity must be maintained to get good reaction between the phosphate and traces of hardness entering the boiler. This is necessary even when a minimum of 30 ppm phosphate is carried. (Jowett Plant lost 19 boiler tubes from scale because of a bad condenser leak and failure to maintain this minimum.)

3. Maximum alkalinity is a per cent of the total solids in a boiler, and as the solids go nearer the ASME maximum, the "M" alkalinity should go closer to 20%.

It might be interesting to study the boiler-alkalinity picture in several of our plants to see what they do to maintain these conditions:

Carlsbad Plant, No. 3 Boiler

600 psi B & W, 100,000 lb per hr
T.D.S. 510 ppm
P.Alk. 204 ppm
M.Alk. 306 ppm
PO_4 70 ppm
pH 11.2

The "P" alkalinity is well above half the "M" figure and the pH is in a good range. The relation between the "P" and "M" reading needed to give this high pH varies with the phosphate reading and also with the concentration of alkalinities.

This boiler uses evaporated make-up so soda ash must be fed to keep the alkalinity above the 200 ppm minimum. Soda ash is sodium carbonate, and at boiler temperatures part of it will decompose to form sodium hydroxide or caustic, (2) and carbon dioxide is released:

Roswell Plant, No. 10 Boiler

400 psi B & W, 80,000 lb per hr
T.D.S. 550 ppm
P.Alk. 242 ppm
M.Alk. 274 ppm
PO_4 35 ppm
pH 11.4

It will be seen at once that the "P" and "M" figures are closer together in this boiler. The reason is that evaporated make-up is used and sodium hydroxide (caustic soda) is fed to the system to raise the alkalinity. But if all the alkalinity was present as hydroxides the "P" and "M" reading would be the same.

Since they are not the same, the difference must be due to phosphates, plus very small amounts of carbonates entering by evaporator carryover, condenser leaks, etc.

This trick of using caustic soda instead of soda ash (sodium carbonate) gives the same alkalinity control without introducing carbon dioxide into the system. When the carbon dioxide is not objectionable some operators prefer soda ash, because it is easier and safer to handle. Our chemist at Tuco, uses common lye in one pound cans. The slight increase in cost over large drums, is written off as a safety measure, and the small cans do not have to be left open to collect moisture, which hardens the material.

East Plant, No. 6 Boiler

300 psi B & W 200,000 lb per hr
T.D.S. 1960
P.Alk. 549
M.Alk. 689
PO_4 50
pH 11.3

This water differs from the two previous examples in that it is more concentrated. Also, the alkalinity present is a result of feeding zeolite water to the boiler, and the make-up is alkaline enough to hold up the boiler figure without feeding either soda ash or caustic soda.

The zeolite water contains bicarbonates. They are decomposed in the deaerating heater, and carbonate alkalinity is formed (1). The carbon dioxide is released to the atmosphere and the carbonates go on to the boiler to be partially decomposed forming hydroxide (2) and more carbon dioxide.

When water-treating problems arise in a plant, it is helpful to know the generally accepted practices, but variations occur in every system. Until plant operation is understood and the exact conditions studied, it is practically impossible to carry out a satisfactory water-treating program.

REFERENCE EQUATIONS

(1) $2\,NaHCO_3$ (Bicarbonate) + Heat = Na_2CO_3 (Carbonate) + H_2O + CO_2.

(2) Na_2CO_3 (Carbonate) + H_2O + Heat = NaOH (Hydroxide) + CO_2.

(3) $6\,Na_3PO_4$ (Phosphate) + $10\,CaCO_3$ (Hardness) + $2\,NaOH$ (Hydroxide) = $3\,Ca_3(PO_4)_2 \cdot Ca(OH)_2$ (Apatite) + $10\,Na_2CO_3$.

Calcium hydroxy apatite is the reddish white powder found in boilers treated with phosphate. The deposit is not objectionable in low-pressure boilers (below 600 psi), especially when tannin is used to keep it in suspension.

Insulates Ash Hoppers

● Mineral-wool insulating blocks on outdoor hoppers at the Sewaren Station of the Public Service Electric & Gas Co. of New Jersey keep flyash hot and dry so it will flow freely in freezing weather. The hot flyash is stored in the hoppers and periodically emptied onto conveyers, dumped into trucks and sold. Without insulation low outdoor temperatures would cool the ash, normally received at 284 F, and condense moisture.

The two precipitator hoppers are covered with 1½-in. mineral-wool blocks in 12 x 18-in. sections. Externally applied, the blocks were placed between lugs welded to the sheet-metal surfaces on 12-in. centers. Galvanized iron wires were tightly stretched over the blocks and bound to the lugs. A layer of insulating cement was trowelled over the blocks followed by a ¼-in. thickness of weatherproof finishing cement. Two coats of oil paint finished the installation. The insulation permits uninterrupted operation independent of outside temperature. Courtesy, Industrial Mineral Wool Institute.

ALCOA'S ANSWER TO STREAM POLLUTION

This plant separates oil emulsions from water in a two-stage process consisting of treatment with acid, followed by the addition of a neutralizing alkali. Reclaimed oil is used as dust layer on plant roads

WILLIAM B. McMORRIS, *Aluminum Company of America*

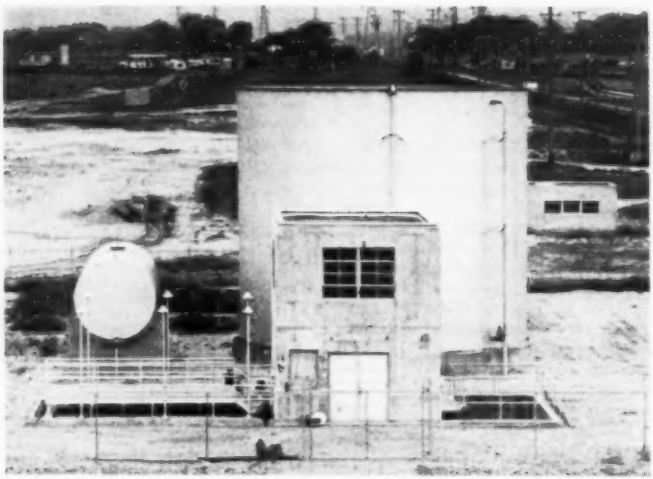


Fig. 1—Sewer system, consisting of 2,500 ft of vitrified pipe, brings hot oily wastes from the hot mill to a 250,000-gal storage tank in the treating plant

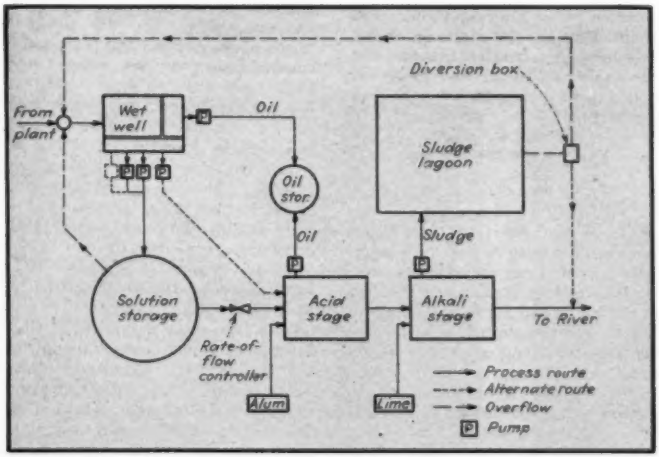


Fig. 2—Plant is designed for a treating rate of 100 gpm. Since waste flow may reach 1,000 gpm, the difference is stored. This provides gravity flow to process

STREAM pollution has become a modern industrial headache and the only effective remedy is an efficient waste disposal system. Consequently, the Aluminum Company of America has installed an efficient waste treating plant, Fig. 1, at its new 52-acre sheet and plate rolling mill in Davenport, Iowa. Particular care was taken to avoid polluting the Mississippi River, which forms one of the site boundaries, because the water supply intake of the City of Davenport is located only four miles downstream from the plant.

The disposal system is made up of three separate components. A storm sewer drains over 15 mgd of uncontaminated cooling water into the river. Actually, this water is cleaner than when it was taken from the river. Domestic wastes are picked up in the sanitary sewer system and sent to the sewage disposal plant where they are treated in a conventional single-stage high-rate filter process prior to discharge to the river.

Waste Oil System

A third, and the most intricate, sewer system, consisting of 2,500 ft of 12 and 15-in. vitrified pipe, serves the hot mill end of the plant and carries away oily wastes originating at several points in that area. Small quantities of free oils and greases are produced at the pits where rolls and bearings are cleaned, but by far the greatest volume of industrial waste is soluble oil solution, used as hot mill coolant. Acids, poisons, or noxious wastes are not produced at the Davenport Works.

Investigations preceding plant design showed that the soluble oil emulsions could be separated from the water in a two-stage process involving treatment with an acid, followed by the addition of a neutralizing alkali. A flow sheet was developed along these lines to include:

1. Application of an acid salt to produce the optimum pH for emulsion cracking. Filter alum is used here.
2. Settling.
3. Application of an alkali to adjust the pH to a point where an alum floc is formed.
4. Settling.

The soluble oil solutions, containing two to five per cent soluble oil in the form of an emulsion, are discarded from time to time because of partial cracking, souring, or other failures. Generally, batches of from 100,000 to 150,000 gal are expected to issue as waste from the hot mills, while the scalpers may discharge up to 2,500 gal in a single batch. There is also a more or less constant flow of waste from the soluble oil conditioning equipment. Week-end cleaning of the soluble oil pump pits also adds a load to the waste

disposal unit. Peak flows approach 1,000 gpm. Within a few hours up to 200,000 gal may be expected. Because of the widely varying rates of flow reaching the disposal plant, it was thought advisable to design for both batch and continuous treatment, Fig 2.

Peak inflow was assumed to be the flowing-full capacity of the industrial waste drain—1,000 gpm. Rate of flow through the treatment process was established at 100 gpm for reasons of economy. Difference between inflow and treatment rates was taken care of by installing a 250,000-gal storage tank just ahead of the treatment process.

Upon reaching the treating plant, the oil-bearing waste flows into a 15,000-gal wet well where a certain amount of skimming takes place. Transfer of the solution to the storage tank is done by two pumps—one of 1,000-gpm capacity, and the other rated at 500 gpm. Both are controlled by a float program switch. A third pump of 100-gpm capacity transfers the waste directly into the process tank when desired. The pump room is also equipped with oil pumps, which deliver skimmings to the oil storage tank.

The 250,000-gal circular steel storage tank (big enough to handle the combined capacities of the major sources of coolant) is located above ground to obtain gravity flow through the process. The 100 gpm design flow is obtained by means of a venturi-type rate-of-flow controller.

Treatment of the waste takes place in the two-story tank in Fig. 3. Upper compartment is rubber-lined steel, and the lower, or outer, tank is concrete. Raw waste enters the small compartment at the influent end of the upper tank where it is mixed with alum, applied by dry chemical feeders. The acidified solution overflows into the main body of the upper tank for a 1½-hr detention period. In this stage the emulsified fractions separate into suspended gelatinous curds with the release of small quantities of free oil.

The liquid then passes into the small compartment at the effluent end of the upper tank where it receives a rapid mix with lime from a dry feeder. Passing downward from the lime mixing compartment, the alkalized solution enters the lower compartment for a 4-hr sedimentation period. Here the alum sludge drops to the bottom while the clarified liquor rises to overflow the weirs for discharge to the river.

Oils released from the emulsion in the upper tank are removed by a mechanical skimmer and are pumped, along with the wet well skimmings, to a 1,500-gal above-ground storage tank. It has been found that the oil will burn. Its chief use so far, however, has been as a dust layer around the plant. Sludge deposited in the lower compartment is collected mechanically and pumped to a lagoon for storage and further settling. Further breakdown takes place in the lagoon and results in the release of more oil. Provisions have been made to return skimmings from the lagoon to the wet well, and thus to the oil storage tank.

The longitudinal section through the treatment plant in Fig. 4 shows how a single structure was made to incorporate wet well, process tanks, chemical feeds, pump and control rooms. The structure is reinforced concrete. Rubber lined valves are used for handling acid solutions. Ordinary materials are used for pipelines, valves, pumps, etc. in all other locations.

Records for over a year's operation show that total oil in the effluent is consistently below 10 ppm. Needed quantities of chemicals vary widely so daily tests are made to determine the best dosages for coagulation and settling. Alum requirements range from 15 to 90 grains per gal although the normal dose is between 20 and 25 gpg. Lime dosages run from 35 to 200 gpg with 35 to 45 gpg representing the usual requirements.

The larger dosages are needed when the wastes contain quantities of alkaline cleaning compound used for equipment washdown. During periods of high chemical requirements the use of acid has been found helpful in cracking the emulsions besides saving alum. It has not yet been found necessary to install permanent acid feed.

The plant was designed by Alcoa's General Engineering Department, under the direction of J. W. Schreiber, Chief Construction Engineer. Walker Process Equipment, Inc. developed and furnished the basic equipment.

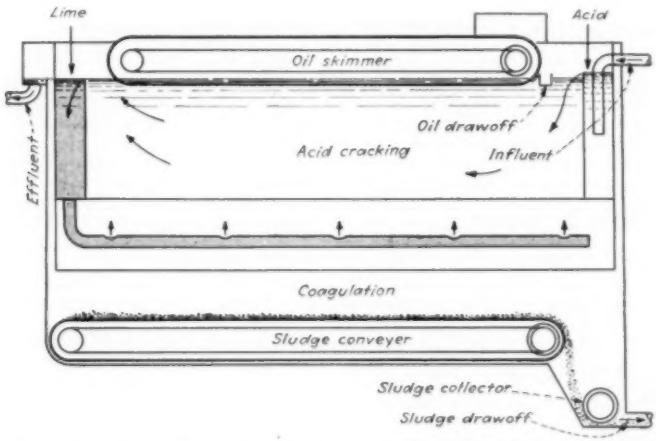


Fig. 3—Raw waste enters upper tank where it is mixed with alum and retained for 1½ hr. Liquid then passes out and is mixed with alkali for next retention period

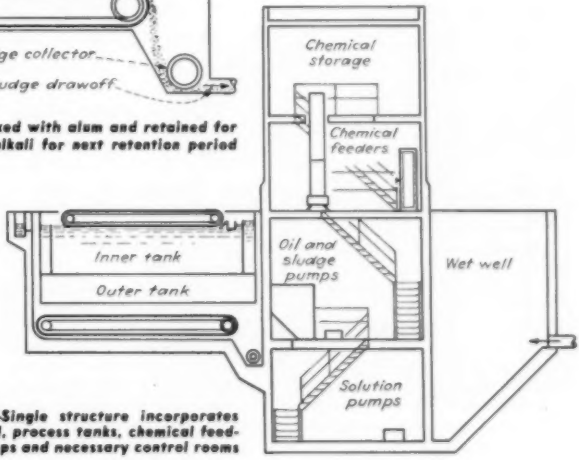
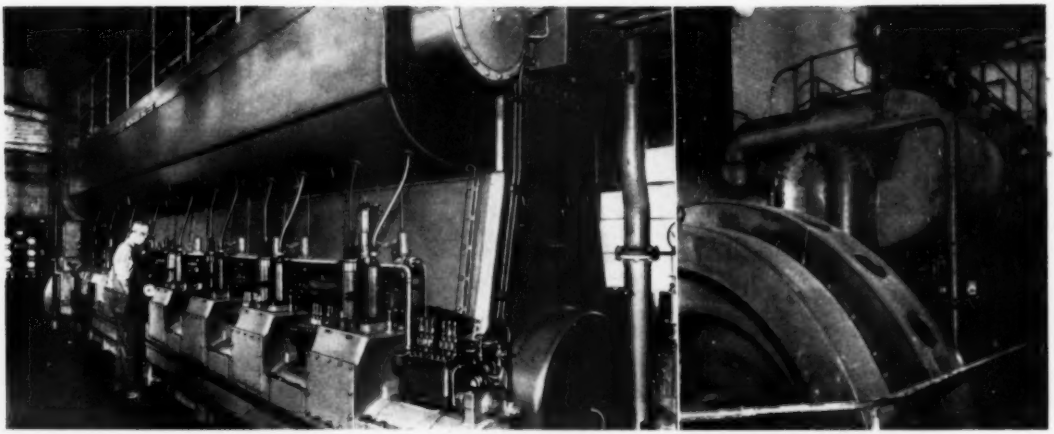


Fig. 4—Single structure incorporates wet well, process tanks, chemical feeders, pumps and necessary control rooms



Individual cylinder forced feed lubrication is inspected by the plant engineer. Lube oil consumption has been negligible since the unit was placed on line. Generator, right, has corrected rating of 2,360-kw for 2,000-ft elevation

PHILLIPSBURG KANSAS HAS FIRST LARGE

In line with the Western Light & Telephone Company's major expansion program, the most efficient and latest dual fuel diesel-generating unit has been installed

WESTERN LIGHT & TELEPHONE CO., one of the three largest public utilities in the state of Kansas, has expanded its facilities for the generation of electric power. Diesels have long played an important part in this company's power activities and internal combustion units have had a major role in the expansion program throughout.

Recent installations at seven Kansas generating stations include two steam turbines, two oil-burning diesels and four dual fuel engines. One of the notable dual fuel installations was at Phillipsburg, Kansas, where a 3,400-hp two-cycle Nordberg unit is now in regular service. This engine, one of the first of its type, burns natural gas at low pressure with a small quantity of oil as pilot fuel, and it can be switched instantly from dual fuel to full oil operation.

Western Light & Telephone is providing utility services to approximately 47,500 electric customers in Kansas and Missouri, 4,500 water customers in Kansas, 4,500 gas customers in Kansas and 48,900 telephone subscribers in Kansas, Missouri, Iowa and Oklahoma. Electric production has expanded steadily in recent years. Peak loads have risen from 19,000-kw in 1943 to 42,000 in 1950, and total production has grown from 69,853,000 kw-hr in 1943 to more than 150,000,000 kw-hr for the full year of 1950. Total generating capacity has gone from 27,500 to 50,500-kw and diesel capacity from 10,050 to 22,150-kw.

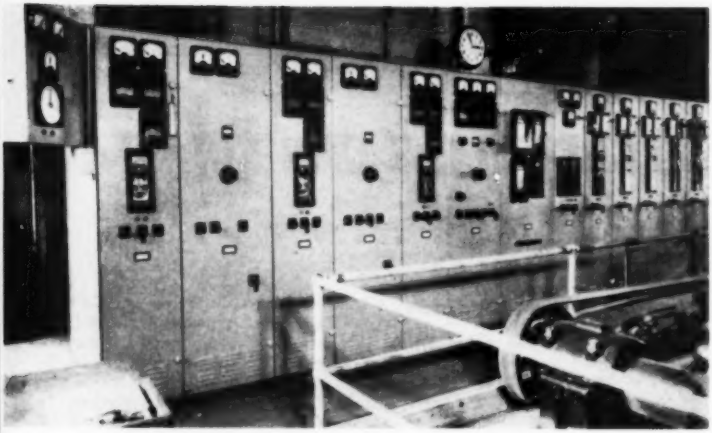
Engine Particulars

This engine has eight cylinders of 21½ in. bore and 31 in. stroke with a rating of 3,400-hp, 2410-kw at 225 rpm. At the Phillipsburg altitude of 2,000 ft the unit is rated 3330-hp, 2360-kw. Until recently there were no two-cycle engines as large as this that could be switched instantly from gas to oil or from oil to gas. However, a large number of big, two-cycle convertible gas engines are operating successfully in the field, but these units inject gas at high pressure and require several hours to switch to full diesel. In operating this engine gas is admitted at low pressure, and the engine can be changed from one fuel to the other by the simple movement of the control lever.

Gas (with a heating value of 950 Btu per cu ft) reaches the plant at 48 to 50 psi, passes through a meter, a scrubber and then a regulator, which reduces pressure to 20 psi. At this pressure it passes through an admission valve into the engine's gas header and then through another admission valve at each cylinder. The opening of the valves at the cylinders is accomplished hydraulically by individual actuator pumps controlled by the governor. The engine shuts down automatically if lube or pilot oil pressure fails. The pilot oil is injected by the same fuel pumps and injection nozzle used for full oil operation. The pumps are especially calibrated to meter accurately the small quantities of oil required for service. The pilot charge is on continuously.

Fuel at Phillipsburg is trucked to the plant from a local refinery and stored in two tanks with a combined capacity of 44,000 gal. A motor-driven transfer pump sends the oil from storage through meters to underground 1,000 gal day tanks. Engine driven supply pumps take oil from the day tanks through duplex filters.

This engine is easy and economical to lubricate. Oil for bearing lubrication and piston cooling is circulated by an engine-driven pump and the circuit includes a shell and tube oil cooler. A motor-driven auxiliary lube pump cuts in automatically if oil pressure drops. Part of the lube is drawn from the sump by a motor-driven pump and put through an activated clay purifier from which it returns to the sump. Oil is supplied to the cylinders by an individual force-feed lubricator for each cylinder. So far



Impressive switchgear panel and control board are the key to power generation and distribution. Operating equipment is protected by visual and audio alarms

DUAL FUEL INSTALLATION

EDWARD P. HENNEK, *President*
Western Light & Telephone Co.

adding oil to the crankcase supply has not been necessary. In the first three months of operation, the engine used 816 gal of oil, which figures to about 5,840 hp-hr per gal of lube.

Scavenging air is drawn from outside the plant through an automatic self-cleaning filter and intake silencer to the engine-driven blower. Exhaust gases vent through a vertical silencer.

A separate-closed cooling system was installed with the new engine. One motor-driven centrifugal pump circulates soft water through the engine jackets and through a heat exchanger. A second similar pump puts raw water through the exchanger and an induced-draft cooling tower. City water, used for make-up, is treated in a zeolite softener system.

Diesel Accessories

At the side of the diesel is a gage panel, which includes an exhaust pyrometer, control switches for motor-driven engine auxiliary equipment, gages and an alarm panel. Alarms sound and indicator lights go on if jacket water pressure, jacket water temperature, raw water pressure, lube pressure or fuel oil pressure go outside prescribed limits.

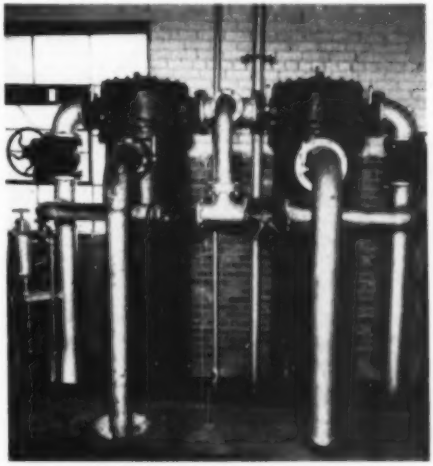
The big engine drives a 2,500-kw, 3,125-kva, 2400-v generator with a V-belt driven exciter. A complete new switchboard was installed at the same time the new engine went in.

In any multi-plant utility system, maximum efficiency of an individual plant is necessarily subordinated to the efficiency of the system as a whole. Every week, an operating schedule detailing the hours and load of each generating unit is issued from operations headquarters. For a typical week in October, 1950, the following operating schedule was ordered: 8 a.m. to 11 a.m. 1700-kw, 11 a.m. to 5 p.m. 1500-kw, 5 p.m. to 8 p.m. 2000-kw and 8 p.m. to 11 p.m. 1500-kw.

Some days the unit is required to pull additional loads up to capacity, depending upon system requirements and conditions. Every prime mover is in effect in competition with all the other available power sources in the utility's system, and a regular 15-hr operating day speaks well for the relative economy of the new engine.

PRINCIPAL EQUIPMENT OF PHILLIPSBURG INSTALLATIONS

Engine	Nordberg Mfg. Co.
Generator	General Electric Co.
Exciter	General Electric Co.
Lube Oil	Socony-Vacuum Oil Co., Inc.
Purifier	Honan-Crane Corp.
Oil Cooler	Ross Heater & Mfg. Co., Inc.
Lubricators	Manzel, Inc.
Lube Oil Pump	Blackmer Pump Co.
Heat Exchanger	Ross Heater & Mfg. Co., Inc.
Cooling Water Pumps	Ingersoll Rand Co.
Cooling Tower	The Marley Co.
Water Softener	Zeolite Softener, Royal
Fuel Oil Transfer Pump	Maxim Silencer Co.
Fuel Meter	Neptune Meter Co.
Fuel Oil Filter	Wm. W. Nugent & Co., Inc.
Fuel Injection Pump	American Bosch Corp.
Gas	Kansas-Nebraska Natural Gas Co.
Scrubber	Blaw-Knox Co.
Gas Regulator	Emco, Rockwell Mfg. Co.
Actuator Pumps	American Bosch Corp.
Governors	Woodward Governor Co.
Alarm Panel	Nordberg Mfg. Co.
Pyrometer	Alnor, Illinois Testing Laboratories, Inc.
Gages	J. E. Lonergan Co.
Alarms	Viking Instruments, Inc.
Switchboard	General Electric Co.
Air Filters	American Air Filter Co., Inc.
Blower	Roots-Connersville Blower Corp.
Exhaust and Intake Silencer	Maxim Silencer Co.



Vertical shell and tube heat exchangers cool jacket water and lube oil with recirculated softened water

MECHANICAL DIFFERENTIALS CAN SOLVE TRANSMISSION PROBLEMS . . . . . IF

they are properly selected and engineered. Here are some basic facts — both theoretical and practical — that will assist the plant engineer in familiarizing himself with automatic variable speed drives

W. F. PRIEST and G. R. TOOMEY,
Mechanical Engineers,
Simplex Wire and Cable Co.

INVESTIGATING the possibilities of mechanical differentials for solutions of speed control problems will prove advantageous for many machine designers. Through a consideration of the many functions available, one can readily begin an inexpensive and altogether different approach.

With a differential employed in connection with a variable drive any number of speed ranges is possible. Also, as the unit can reach zero speed, material may be handled at a predetermined tension without harm or need of an operator's attention. Such an arrangement would resemble that shown in Fig. 1. The basic idea is material passes over or under three devices, two fixed and one movable, the design depending upon the material to be controlled. This unit serves two purposes; it delivers desired tension and controls the velocity of the takeup through a hydraulically controlled differential. Employing this method makes possible the synchronized control of two machines or even machine sections.

The construction may be that of a package unit similar to Fig. 2. If space is at a premium, the differential may be located in a different position with respect to the variable drive and driven by V-belts. The size of the unit may be large or small according to the power required. The control can be either manual or automatic as desired.

Fig. 2 shows the variable drive as a hydraulic operated unit for automatic control. With a control such as this zero to 400 rpm speed is possible in a matter of seconds. The differential is coupled to the control shaft directly. This particular differential unit contains bevel gears mounted on ball bearings in a fabricated case of plate steel with flange cartridge shaft bearings.

General construction of the differential is illustrated in the section detail, Fig. 3. Bevel gears A and B (and their driving gears) are mounted on ball bearings in order that they may rotate independently of the arm shaft supporting them. Between A and B is an arm secured to the arm shaft that supports the two idler gears C and D. Only one gear is required, but the additional one aids balance and increases operation efficiency. The idler gears are also mounted on ball bearings in order that they may freely turn on the arm.

Because this differential is a 1:1 epicyclic bevel gear train, the general epicyclic formula applies. That is:

$$\text{Train value} = \frac{\text{Speed of A relative to the arm}}{\text{Speed of B relative to the arm}}$$

In Fig. 2, the arrows show the direction of rotation. For simplicity where the motion of the near side of the gear is up it is designated as plus rotation, and where down minus rotation.

Since all the bevel gears are the same size the train value between A and B is —1. In other words, with the arm locked, one positive rotation of A will be transmitted through the idlers to one negative rotation of B.

Direction of rotation of the arm shaft is shown as ± because its rotation depends upon what gear is turning the fastest, A or B. The arm always follows the direction of the fastest gear.

The formula for the epicyclic gear train now is:

$$-1 = \frac{+(+A) - (\pm \text{Arm})}{+(-B) - (\pm \text{Arm})}$$

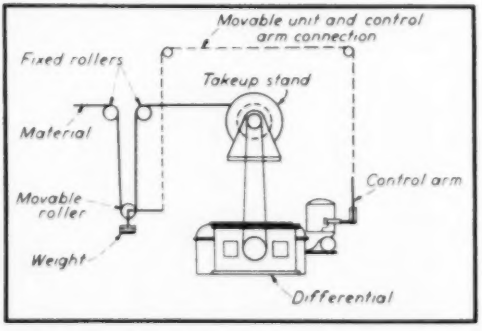


Fig. 1—Tip speed of roller is kept constant to eliminate tension in the material by a weight operated differential

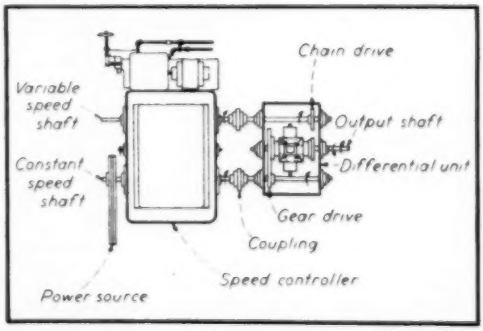


Fig. 2—Hydraulically controlled variable speed reduction unit can be either direct or V-belt driven at 0 to 400 rpm

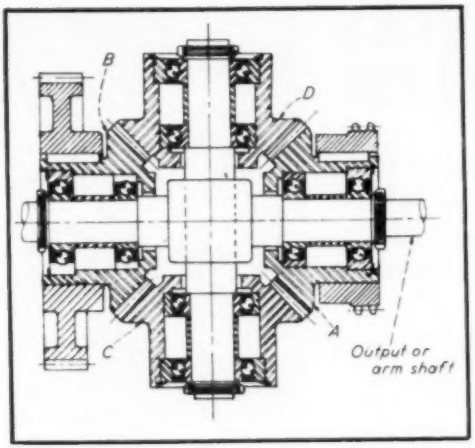


Fig. 3 — Enlarged detail of differential construction shown in Fig. 2. Bevel gears A and B rotate independently of the shaft that supports them both

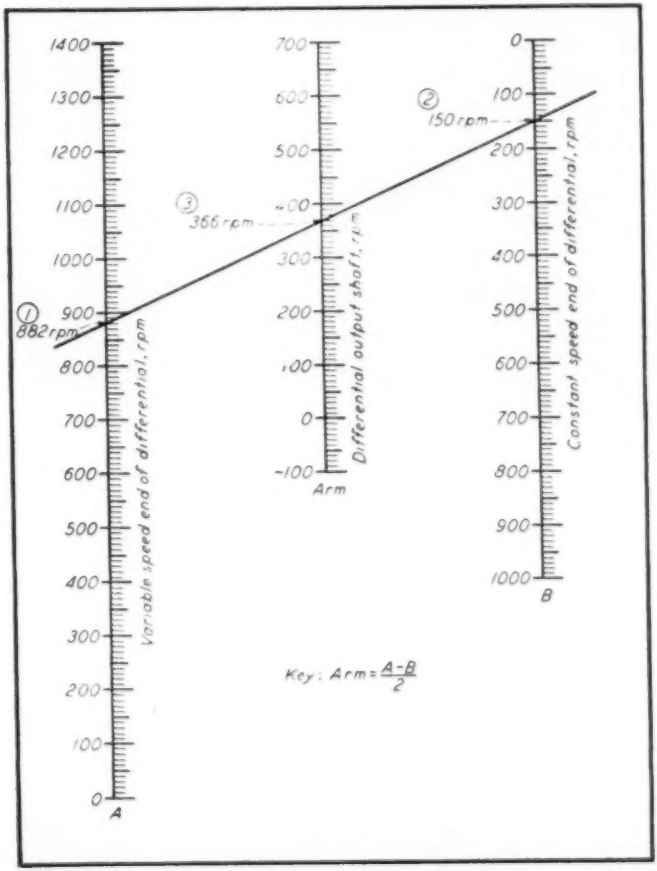


Fig. 4—Linear chart for quickly obtaining differential speeds. By drawing a straight line between the speeds A and B, the speed (test problem) is 366 rpm

Transposing the equation and solving for the arm gives the formula for determining differentials:

$$\pm \text{Arm} = \frac{A - B}{2}$$

Regardless of the direction of rotation of the arm shaft, its rpm is equal to ½ the difference of rpm between the variable gear A and the constant gear B.

Fig. 4 is a chart that may be used for finding these approximate values quickly. A straight edge laid on two known values will line up with the unknown value.

Sample Calculation

Consider a typical problem: Assume that specifications require a variable speed drive unit. The design will be similar to that shown in Fig. 2 and the output shaft is required to operate from 0 to 350 rpm. However, to assure efficient operation the range considered should be less than 0 (approximately −2) to over + 350. Only the shaft speeds will be considered.

For the first try a 6:1 unit will be selected. The constant shaft is to rotate at 360 rpm and the variable shaft speeds are; $360 \times \sqrt{6} = 882$ rpm maximum, and $360 \div \sqrt{6} = 147$ rpm minimum. With a 1:1 chain drive, the variable speed shaft of the differential will be the same as the control unit. The constant speed shaft of the differential should be a little above the minimum variable shaft, say 150 rpm.

The differential calculated speeds are:

$$\text{Max} \frac{882 - 150}{2} = 366 \text{ rpm}$$

$$\text{Min} \frac{147 - 150}{2} = -1.5 \text{ rpm}$$

The reduction for the spur gears in the differential may easily be found through the ratio:

$$\frac{\text{Constant speed of control unit}}{\text{Constant speed of differential}} = \frac{360}{150} = \frac{2.4}{1}$$

It is now possible to find the proper gear sizes. The basic problem is solved although it may be necessary to recalculate the above speeds due to the other variables in designing the unit.

In order for the differential to transmit absolute constant velocity, the source of power must be constant and the gears must be such that the common normal to the profile of the tooth curve at the point of contact will always pass through the pitch point. This of course holds true for any mechanical drive. A unit, driven by an average motor for the power source and with carefully cut gears, will have an output rpm variation of about ∓ .087 per cent.

SPECIAL BELT REDUCES SLIPPAGE AND POWER LOSS

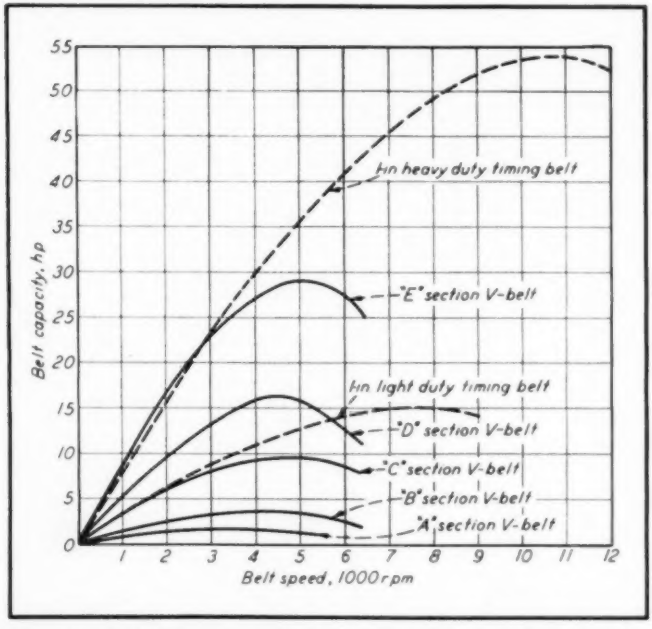
After twelve years of research and development this company finally has produced a mechanical power transmission drive that has eliminated slippage and power loss. Even though the drive is now available further development work is underway to investigate improvements.

AFTER TWELVE YEARS of research the United States Rubber Company has developed a mechanical power transmission belt distinctly different from the conventional flat or V-belt. This belt, when applied with companion pulleys, affords positive engagement and eliminates slippage and subsequent power losses. This new item, now under production by this company, will be known as the "Gilmer Timing Belt."

Perfected by the L. H. Gilmer Div., the belt is similar in appearance to a flat belt except that it has regularly spaced rubber teeth along its inner surface. These teeth engage in corresponding grooves in drive and driven pulleys to form a positive means of transmitting power. This offers a definite anti-slip characteristic, and it can be adapted to mechanically driven units demanding precision timing. The belt is so constructed that stretching is at the minimum, and no adjustments in the pulley centers are necessary even after continued operation.

Basically, the belt is made with neoprene compounds for general use. However, Buna-N is employed when the belt is subjected to extreme heat and oil conditions. Two strength belts were developed. For normal power transmission drives the belt is strengthened with steel. For light loads, such as timing equipment and fractional horsepower operation, Ustex—a cotton cord chemically treated for high strength—is employed to strengthen the rubberized material. Neither of these belts require lubrication or dressing for proper operation, but slight amounts of oil cause little or no harm.

Positive engagement between belt and pulley is assured, even at 16,000 rpm



Comparison of the horsepower ratings between the timing and V-belt drives. Size for size, this belt will transmit more power and will peak at much higher speeds

One predominant feature of this belt is its extreme flexibility. This permits speed ratios of 30-1 at belt speeds up to 10,000 rpm. In addition, maintenance costs are low because of the absence of take-up from stretch, elimination of lubrication, infrequent replacements and elimination of power waste.

No horsepower tables have been published so far for these drives. But, the company is in a position where horsepower tables can be made and published on stock drives. Horsepower curves are shown in the graph for multiple V-belts and the proposed stock, heavy and light duty flat belts. This graph indicates that the flat belt, size for size, will transmit considerably more horsepower than the V-belt, and at the same time peaks at a higher speed.

Even though the United States Rubber Co., now have this belt and drive in production, they are going ahead with an extensive program of development. At present they feel that the fundamental and basic development is completed, but they also feel that other projects are desirable such as further treatment on: (1) investigation of misalignment, (2) different types of strengthening materials such as fiberglas and others, (3) extreme resistance to oil and heat, (4) noise and how to reduce this already quiet operating unit, (5) additional work on tooth forms and (6) developing a belt with teeth on both sides.

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Air-Cooled Heat Exchanger

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These exchangers, developed jointly by The Griscom-Russell Co. and Fluor Corp. Ltd., are self-contained package-type units. They include G-R K-Fin Heat Transfer Sections with Fluor air circulation equipment, all mounted in a sturdy compact structure.

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And these are only some of the many Fin-Fan benefits and advantages. Get the whole story of this important development in heat transfer apparatus . . . write for bulletin and ask for specific recommendations on Fin-Fan for your cooling and condensing needs.

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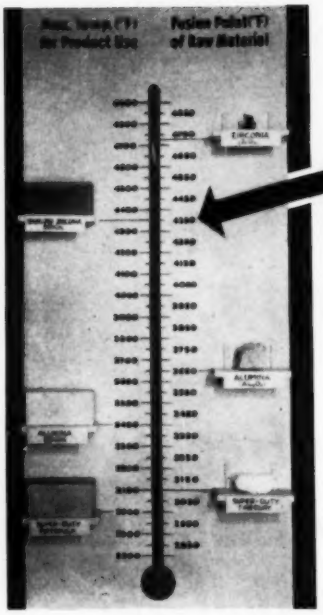


DEVELOPS REFRACTORY FOR ULTRA-HIGH HEAT

Good at 4350 F

Here is an old material made practical as a super refractory by recent developments in crystalline structure. Higher melting than alumina, less reactive than magnesia, it is a better insulator

Left—high melting point of zirconia not only means increased efficiency for many processes, but practicability for some that are otherwise impossible

DEVELOPMENT and introduction of fused, stabilized zirconia for the first time at a commercial price is opening up a whole new field of operation for industry. Although the field and potential market for zirconia heavy refractories cannot be too easily identified at the current stage of development, this material is being used successfully in either oxidizing or reducing atmospheres up to 4600 F.

Prompt acceptance for the refractory was found in markets where efficiency is largely dependent on temperature of operation, as in fixation of nitrogen, various gas synthesis operations, and melting of special alloys and metals.

Properties of stabilized zirconia making it a valuable refractory are: (1) very high melting point of approximately 4620 F, (2) thermal conductivity that is only one third that of alumina or magnesia, (3) low volatility, (4) thermal shock resistance that withstands frequent, rapid and extreme heating cycles, (5) low reactivity even at elevated temperatures and (6) low electrical resistivity at high temperatures.

Its value for furnace linings is illustrated by gas synthesis reactions, where high melting point and low volatility are important for efficiency and durability. Also, thermal conductivity of only 6 Btu per hr per sq ft per in at 2000 F confines the extreme temperatures without large heat losses. Thermal shock resistance is necessary because the furnaces are heated very rapidly.

Other important uses include fixation of nitrogen, sintering of tungsten, ceramic kilns for firing over 4000 F, setters for firing titanate dielectrics, and containers and conveyers for molten steel.

Laboratory furnaces have been constructed using stabilized zirconia tubes as resistors. The material has a negative coefficient of resistance and becomes a good conductor at high temperatures. This, together with other high temperature properties, make it an excellent resistance element for electric furnaces up to or above 4000 F. Though the resistors are not yet used for industrial applications, construction principles for furnaces, which also have zirconia walls, have been delineated and large units could be built.

Stabilized zirconia does not undergo the crystaline change found at about 1800 F in the ordinary material. The change from the low temperature monoclinic form to the high temperature tetragonal form is accompanied by a 0.70 per cent shrinkage which is responsible for mechanical failure unless the transition temperature is passed with unusual care.

Addition of a few per cent of oxide of magnesium, calcium, scandium of yttrium stabilizes the zirconia by causing it to keep its high temperature

Recent demands for high temperature refractories, and the unique properties of fused stabilized zirconia brought development of many shapes, including granules

form at room temperature, avoiding the transition and making it a practical refractory. Zirconia composed entirely of stabilized crystal has a high expansion coefficient and requires addition of some low-expansion unstabilized crystals for good resistance to thermal shock. Composition is determined by X-ray crystallographic methods.

Automatic processes are being developed to speed molding of many shapes. At present, all standard sizes of bricks and some plates, discs, tubes and special shapes can be obtained.

Fused, stabilized zirconia is a product of research and development by the Norton Company. Investigations on properties and uses have produced the engineering data necessary for the design of new processes and equipment. A summary of information on the most popular type follows:

Melting point is 4620 to 4710 F.

Density varies with porosity:

True value	5.6 gm/cc
Bulk value	
dense type	4.4 gm/cc
insulating	2.5 gm/cc

Thermal conductivity at 2000 F:

Dense shapes	6.2 Btu
Insulating shapes	4.7 Btu
Insulating grain	2.8 Btu

Mean specific heat is .175.

Coefficient of expansion is given as 65×10^{-7} between 750 and 2280 F.

Load bearing capacity is given as the point at which collapse occurs when the material is heated at 10 C per min, loaded as follows:

10 psi	3830 F
40 psi	3535 F

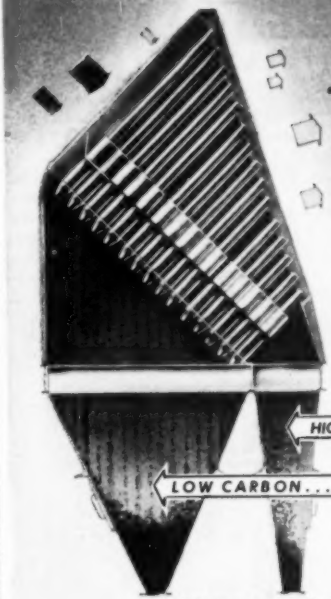
Specific resistivity in ohm-cm varies with temperature given in degrees F:

1290	2300
2190	77
2370	9.4
3090	1.6
3630	0.59
3990	0.37

Interesting applications show the versatility of the material. Induction furnace walls of zirconia generate heat at high temperatures, and, because of high electron emission, conduct current even across cracked sections. Molten steel does not wet or erode containers or walls which it contacts.

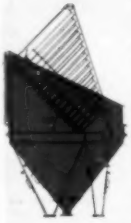
Furnace linings operated up to 4625 F and exposed to high velocity gas streams have shown indications of surface fusion and fluidity, but because of the high thermal gradient, the rest of the lining remained structurally strong. Liners for jet and rocket engines are currently under test.

REFIRE HIGH CARBON DUST
without recirculating fly-ash



. . . install P-D
TUBULAR DUST COLLECTORS
arranged for
DECANTATION

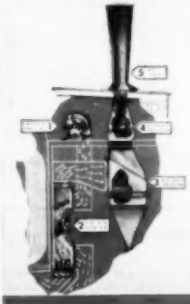
In a single phase P-D tubular collector, designed for decantation and *requiring no additional pressure drop*, it is now possible to separate the large particles of high carbon content from the non-combustible finer particles.



Fly-ash from spreader stoker-fired units, consisting of up to 40% high carbon particles, can effect considerable savings when re-injected. It is necessary to effect separation, however, since the non-combustible smaller particles remaining in the system increase in concentration, causing erosion and possible poor combustion due to spotting.

Space requirements for the decantation design are not as great in area and only slightly higher than a standard tubular . . . and, collection efficiency is high. Superimposed sketch shows comparative size.

Why waste fuel? Investigate this collector today, it will soon pay for itself. Write our Sales and Project Engineers for Bulletin 260 D.



UNIT RESPONSIBILITY

Prat-Daniel, through its sales and project engineers, The Thermix Corp., offer a complete complement for handling the air gas stream: Forced Draft Fans, Air Pre-heaters, Tubular Dust Collectors, Induced Draft Fans and Fan Stacks. This unit responsibility, by a well known firm, relieves the engineer of the responsibility for one of the most important functions in a steam generating plant.

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PERLITE--A WEIGHT SAVER

PERLITE, mined in many of the western states, is of volcanic origin. The material is high in silica and is often referred to as volcanic glass. When heated to a softening temperature the entrapped gas expands, giving the substance a sponge-like appearance. Thus, proper preparation produces light granules containing countless voids or pockets, which give them good insulating qualities and high fire resistance.

Before preparation the ore weighs 80 lb per cubic foot, and the finished material weighs as little as 2 lb. Used as aggregate for concrete, the finished product can be sawed, nailed and drilled. Considering 100 square yards of standard three-coat, 5/8-in. plastered surface, substitution of perlite for sand aggregate makes a saving in plaster weight of from 2,000 to 4,000 lb.

Several thousand tons of steel were saved in constructing the General Petroleum, Prudential Life and Sinclair Oil buildings by fireproofing the steel work with perlite concrete instead of the sand and stone variety. Using perlite concrete and special lightweight steel members enabled a Houston, Texas contractor to build a twenty-two-story building on an eighteen-story foundation.

Steel has been in short supply for some time, and the situation apparently is going to get worse. As the continuing defense requirements of the nation are met, the amount of steel available for construction uses will decrease and perhaps even be allocated.

From an insulating standpoint perlite compares favorably with presently available materials. It can be used in the temperature range of from sub-zero to 2,000 F. Perlite-aggregate plaster is about four to seven times better as a heat insulating medium than the sand variety. The former has a K factor of 0.4 to 0.8, while the latter's K factor is 3.00 to 3.50. Under tests, sand and gravel concrete showed a K factor of 1.85 as compared to 0.726 for that of concrete made with perlite. Water penetration does not affect perlite's insulating value; tests made in humid summer weather showed it absorbed only 0.2 of 1% moisture.

When used as a loose fill, perlite does not settle by breakdown or compression of particles, but does settle slightly from vibration in a wall by the rearrangement or fitting together of particles. To overcome this, it has been demonstrated that eighteen volumes of perlite to one volume of portland cement—with just enough water to complete hydration — makes a mix that, when poured into a hollow wall space, sets up enough to hold together firmly and permanently and provides a dry wall of good insulating value.

Courtesy of Flexicore Company of Colorado; General Perlite Co; Great Lakes Carbon Corp; Smith-Emery Co; U. S. Gypsum Co; Western Perlite Corp.

BULK DENSITY OF PACKED LOOSE-FILL PERLITE TO K FACTOR

Bulk density, lb per cu ft	K factor
2.50	0.200
4.88	0.267
6.00	0.324
8.50	0.345
11.00	0.450

SAVINGS IN BUILDING CONSTRUCTION

1. Fireproofing for an 18 WF 50 beam with regular concrete weighs 225 lb and costs $3.45 per lineal foot.
2. Lightweight plaster (perlite) fire protection for this same beam weighs less than 25 lb, and costs $2.20 per lineal foot.
3. With this construction we save dead weight of 200 lb and 85 cents per lineal foot for fireproofing.
4. Although a premium of $5.00 per yard was paid for the lightweight concrete, as opposed to stone concrete, a saving of 1,000 tons of structural steel was made in each of two buildings. This amounted to $180,000 on each building as against a premium of $61,000 on one and $72,500 on the other for the concrete.

GENERAL PETROLEUM BUILDING

Lightweight concrete saved	8,300 tons
Structural steel saved	1,000 tons
Lightweight fireproofing saved	1,000 tons
Hollow-wall construction saved	2,800 tons
Total saving	13,100 tons
Dead weight as designed	25,800 tons
Design live load, 1st story col.	8,300 tons
Tonnage of structural steel	3,220 tons
Tonnage of steel joists	570 tons

Note: From a report by Murray Erick & Associates

VOLUME MIX WITH CEMENT SHOWING DENSITY AND THERMAL CONDUCTIVITY

Volume mix, perlite-cement	Density, lb per cu ft	Thermal conductivity, K factor
8 to 1	25.4	0.643
7 to 1	25.4	0.657
6 to 1	27.1	0.693
5 to 1	29.2	0.726
Minus 3 plus 10 expanded perlite	8.67 (loose fill)	0.490
Minus 10 plus 30 expanded perlite	7.34 (loose fill)	0.393

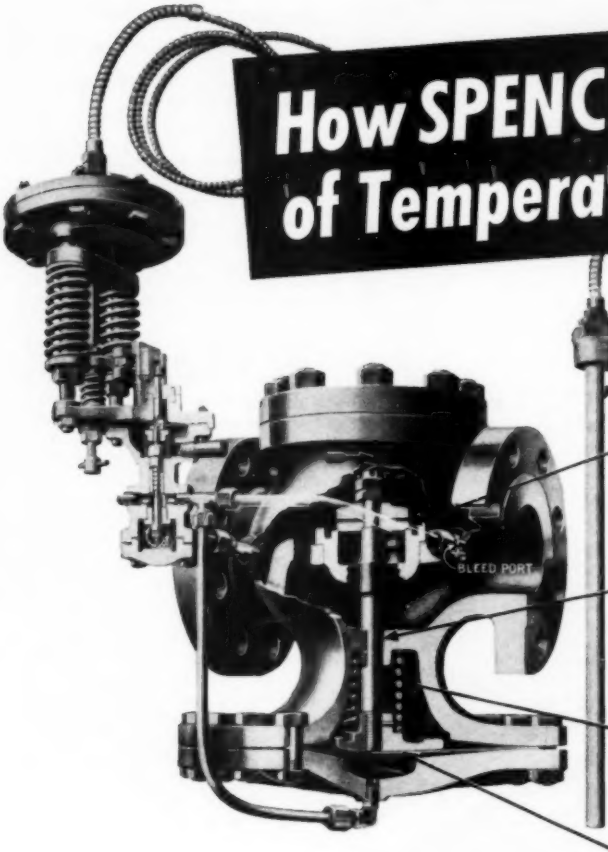
TESTING LABORATORY ANALYSES OF RAW ORE AND PROCESSED PERLITE

Constituents	Raw ore	Processed perlite
Moisture	0.065%	0.05 %
Loss of ignition	3.83 %	0.75 %
Silica	72.40 %	75.70 %
Iron oxide	0.80 %	0.28 %
Alumina	12.70 %	14.42 %
Calcium oxide	0.39 %	0.56 %
Magnesia	0.47 %	0.22 %
Sodium oxide	3.01 %	2.64 %
Potassium	4.08 %	3.99 %

COMPARISON OF STANDARD AND LIGHTWEIGHT AGGREGATE CONCRETES

Type of aggregate	Cement to agg. ratio by volume	Water-cement ratio	28-day density, lb per cu ft, air dry	28-day strength, psi	K factor
Sand & gravel	1 to 6	0.78	150	2,500	12.00
Perlite, 12 lb bulk density	1 to 2	0.80	66	2,500	1.87
Perlite (same as above)	1 to 4	0.85	47	1,200	1.40
Perlite (same as above)	1 to 8	0.90	32	336	1.02

How SPENCE Cuts Costs of Temperature Control



NEW THERMOSTAT ELEMENT—Improved to practically eliminate loss of filling. Rugged construction; cannot be injured by overheating.

SECO METAL—Seats and discs are made of SECO Metal—guaranteed not to wire-draw.

PACKLESS CONSTRUCTION—All Spence main valves and most pilots are built without stuffing boxes. This minimizes friction . . . eliminates much time-consuming maintenance.

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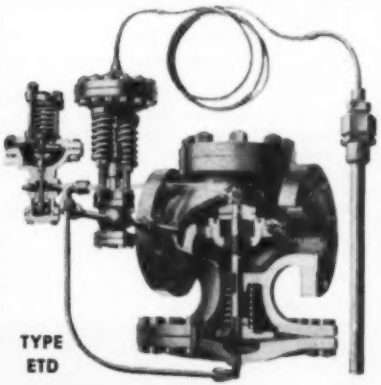
LARGE BALANCED DIAPHRAGM—Spence metal diaphragms, under usual conditions, never require replacement.

Accurate Control for Both Storage and Instantaneous Heaters

Spence Temperature Regulators reduce the steam pressure and also accurately modulate the flow as required to control the temperature. No separate reducing valve is necessary • The Spence ET150 Regulator is recommended for heater pressures up to 50 psi. For higher pressures the Type ETD is available • For complete details on the entire Spence line of automatic regulating valves, strainers and desuperheaters, write for Bulletin 1200.



TYPE ETD

SE 111

Spence

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WALDEN, NEW YORK

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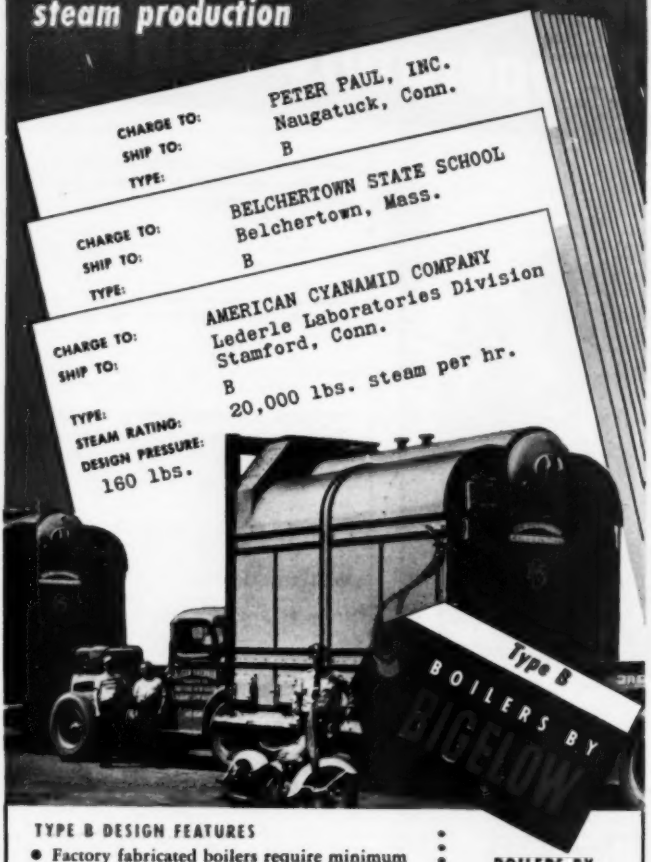
For compact, efficient steam production



TYPE B DESIGN FEATURES

- Factory fabricated boilers require minimum field work.
- In many cases, sizes up to 330 HP can be shipped completely assembled.
- Water tubes along furnace side walls reduce maintenance costs.
- Furnace design provides high efficiency with any method of firing.
- Extremely low head room. Maximum capacity for floor area.
- Can be operated at high overloads without disturbing water level.

Write for free catalog on the Type B or on any of the units listed below.

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Water Tube Boilers — Bent Tube Types

Horizontal Return Tubular Boilers

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Electric Steam Generators

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Kingsport Expansion

(Continued from page 72)

fied limits of the Kingsport dust and smoke control ordinance.

Ventilation

Improvement of paper mill ventilation was the final step in this postwar modernization project. A paper machine room in any latitude is at best a warm place to work during the hot, humid summer months. The problem was aggravated in Kingsport by space limitations, and buildings were grouped so closely together that effective natural ventilation was next to impossible to achieve. Increased machine speeds in the immediate postwar period simply added more motor heat, which led to numerous complains of uncomfortable working conditions.

Generally speaking, such complaints are normal with the advent of hot weather, and for that reason, the degree of discomfort to workmen caused by the combination of hot weather and higher machine operating speeds was not immediately apparent. Once the facts were uncovered, however, management acted to remedy the situation.

The result — a substantial improvement in working comfort to finishing room and machine room operators — stems from a plan utilizing equipment, which provides for supplementing existing ventilation. This is achieved by forcing about 400,000 cfm of filtered outdoor air into the finishing room basement (basement floor being at ground level), which thus becomes a plenum chamber. Individual ceiling fans, strategically located, blow air up and out to the operating area above in more or less horizontal, diffused and directed streams at moderate velocity about four feet above the floor.

At the same time, air removed from heat sources (such as super calenders and paper machine dryers) was increased by installing more and larger exhaust fans and natural vent stacks — all with the idea of developing a total exhaust capacity well exceeding 400,000 cfm forced input.

Winter Heating

During the cold winter months, about 200,000 cfm input to the basement plenum chamber is passed over steam coils with automatic control to 60 F. The regular winter heating and ventilating units for two paper machine rooms pick up this air and deliver it to proper points of application. The balance of winter heating and ventilation is supplied, as in the past, from fan and heater units located above the roof and delivered through ducts to the points of use in the room below.

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CHARGING LEAD-ACID BATTERIES

K. A. VAUGHAN, *Manager, Field Engineering, Gould Storage Battery Corporation*

ONE OF THE MOST widely used methods of charging industrial-truck and mine-haulage batteries is the "Modified Constant Voltage Method". It generally employes a constant-voltage dc generator, although a shunt-wound machine can be used on single batteries.

At the beginning, the batteries are charged at a high rate, the rate depending upon how much they have been dischargd. As the battery becomes charged, the rate automatically tapers off, because the battery voltage rises and approaches that of the generator. Approximately the last 20% of the charge is given at a low finish rate—5 amperes per 100 ampere-hour capacity of the battery. Manufacturers publish recommended finish rates of their batteries and it is important that these rates not be exceeded. If they are, the batteries will overheat and an excessive amount of hydrogen will be given off. When the battery is fully charged, automatic controls disconnect it from the charging circuit.

From the characteristics of the lead-acid battery and by experience, it has been determined that the bus voltage for an eight-hour charge should be 2.63 volts per cell. For example, a 15-cell battery requires a 39.5 generator-bus voltage. This is a little higher than that theoretically required, but it is used because it furnishes a stable charging current.

The ampere capacity of the charging generator is determined by the ampere-hour capacity of the battery and the number of batteries to be charged. For each 100 ampere hours of battery capacity, the generator should be able to deliver a current of 22.5 amperes.

One method of controlling the charge employs an ampere-hour meter, which measures the product of current and time without regard to voltage. It is set to terminate the charge when the ampere hours required to bring the battery to full charge have been delivered. To determine the ampere hours needed, the specific gravity of a pilot cell is taken before charging starts and a chart, supplied by the battery manufacturer, is consulted to give the correct meter setting for that type battery at that specific gravity. Once the meter is set, it is not necessary to reset or take any readings except the final specific gravity.

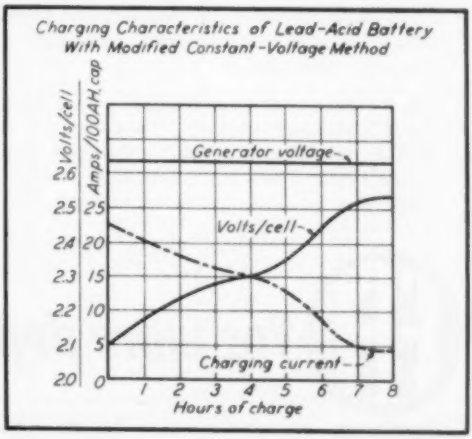
A second method of regulating or controlling the charge, is by means of a voltage-relay timer. Here, a relay operates a timer when the battery reaches that state of charge at which the battery starts to gas—2.37 volts per cell at 77 F. The battery is approximately 80 to 85% charged at this point. The timer, which has been preset, automatically terminates the charge at the end of the time period. The timer setting is generally 2.5 to 3 hours, although it will be greater for older batteries. When specific gravity readings taken at the end of the charge indicate the battery is not fully charged, the timer setting should be increased one-half hour.

Of primary importance to correct charging is the keeping of records. Each battery should be numbered, and when brought in for charging, the date, time, vehicle number, battery number, specific gravity of a pilot cell, and temperature of a pilot cell should be recorded. The same information should be recorded when the battery is taken off charge.

Thus, a complete record of the battery characteristics shows whether it is being correctly charged. For example, if the specific gravity is less than 1.260 to 1.280 at the end of charge, the battery has been undercharged. If the temperature is above 110 F the charging rate has been too high. When the records indicate the battery is being over or undercharged, the reason can be determined and corrected before work stoppage occurs due to battery failure.

When records indicate over or undercharging, the battery should be checked to see that all cells are functioning; charging equipment is correctly adjusted; and instruments are indicating correctly.

The battery-room foreman should be thoroughly familiar with storage-battery technology and should be acquainted with the key points of charging equipment. Some of the larger battery manufacturers periodically conduct courses on these subjects to which they invite battery users. They also maintain field engineering staffs to help solve battery problems at users' plants.



Graph shows generator voltage, charging current and volts per cell when charging by modified constant-voltage method

Your construction

Memorandum
From W L MARTIN, ENGINEERING DEPARTMENT
To J Forbes, Construction Department
Subject I-T-E Switchgear
Jim,
On our order #65136, I-T-E furnished us today with switchboard floor plan, front view drawings, and single line diagrams. We can run conduit, pour floors and set the channel base, ahead of schedule!
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Bill

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Plant Engineer's Handbook

COMPILED BY GENE FELLER

AIR FOR PNEUMATIC TOOLS

The number of tools that can be operated from various size compressors depends on a great many factors, such as leakage, worn hose, and tools that are not in the best operating condition. It is also based on a factor of **intermittance**, which assumes that all tools are not being operated simultaneously. Therefore, many conditions may develop where a lesser or greater number of tools can be operated than shown in the tabulation. *Reprinted from "Compressed Air Handbook", copyright 1947 by Compressed Air and Gas Institute, 122 E. 42nd St., New York 17, N. Y.*

• Compressor capacity more than that needed for usual number of tools.

•• Hoist figures based on 80 psi pressure.

COMPRESSOR CAPACITY, cfm	60		85		105		160		210		315		365		420		500	
AIR PRESSURE, psi	70	90	70	90	70	90	70	90	70	90	70	90	70	90	70	90	70	90
ROCK DRILLS																		
Very light, wet or dry	1	1	2	1	2	2	4	3	5	3	7	5	8	6	10	7	13	9
Very light, blower style	1		1	1	1	1	3	2	4	3	6	5	7	6	8	6	11	8
Light, wet or dry	1		1	1	2	1	3	2	4	3	6	4	7	5	8	6	11	8
Light, blower style			1		1	1	2	1	3	2	5	3	6	4	7	5	9	6
Medium, wet or dry			1		1	1	2	1	3	2	5	3	6	4	7	5	9	6
Medium, blower style			1		1	1	2	1	4	3	6	4	7	5	8	6	11	8
Heavy, blower									2	1	3	2	4	3	4	3	5	4
WAGON DRILLS																		
Light weight					1		1		2	1	3	2	3	2	4	3	5	4
Medium drifter									1		1	1	2	2	2	2	2	2
Heavy drill											1	1	1	1	2	2	2	2
PAVING BREAKER																		
Light, horizontal and light work	2	1	3	2	4	3	6	4	7	5	12	9	14	10	18	12	24	15
Medium, light and general work	1	1	2	2	3	2	5	4	7	4	11	7	13	8	16	9	22	12
Heavy, general work	1	1	2	1	2	1	4	2	5	3	9	5	10	6	12	8	16	10
Heavy, concrete breaking	1	1	2	1	3	2	4	3	6	4	11	7	13	8	15	8	20	12
Heavy, all purpose	1	1	2	1	2	1	4	2	5	3	9	5	10	6	12	8	16	11
PILE DRIVERS																		
Light, gravel	1	1	2	1	2	1	4	2	5	3	9	5	10	6	12	7	16	10
Light, general	1	1	2	1	2	1	4	2	5	3	9	5	10	6	12	8	16	11
Light, stiff ground	1	1	2	2	3	2	4	3	6	4	11	7	13	8	15	8	20	12
DRILL STEEL CUTTER SHARPENERS			1	1	1	1	2	2	3	2	4	3	•	•	5	4	•	•
Light weight	1	1	2	2	3	3	4	4	6	6	•	•	•	•	•	•	•	•
Medium weight	1	1	1	1	1	1	2	2	3	3	•	•	•	•	•	•	•	•
Heavy weight, high production							1	1	1	1	2	2	2	2	3	3	4	4
Heavy weight, greater production							1	1	1	1	2	2	2	2	3	2	3	3
FURNACES																		
Light	3	3	5	5	6	6	10	10	•	•	•	•	•	•	•	•	•	•
Heavy	2	2	4	4	5	5	8	8	•	•	•	•	•	•	•	•	•	•
Heating bits, rods, and steels	2	2	4	4	5	5	8	8	•	•	•	•	•	•	•	•	•	•
GRINDER for detachable rock drill bits			1		1	1	2	1	2	2	4	3	•	•	•	•	•	•
DIGGERS																		
Light, medium duty clay and trench digger	2	1	3	2	4	3	7	5	10	7	18	13	20	15	22	16	•	•
Medium and heavy duty	1	1	2	2	4	2	7	4	11	6	18	11	20	12	22	13	•	•
Heavy duty	1	1	2	1	2	1	4	2	6	4	10	6	11	7	12	7	•	•
RIVETING HAMMERS																		
4" stroke, 3/8" capacity	2	2	4	3	5	3	7	5	10	7	18	13	•	•	•	•	•	•
5" stroke, 1/4" capacity	2	2	4	3	6	4	10	7	15	10	25	18	•	•	•	•	•	•
6" stroke, 5/8" capacity	2	2	3	2	5	3	8	5	12	8	19	14	•	•	•	•	•	•
8" stroke, 1 1/8" capacity	2	1	3	2	4	3	7	5	10	7	17	13	•	•	•	•	•	•
9" stroke, 1 1/4" capacity	2	1	3	2	4	3	7	5	10	7	17	13	•	•	•	•	•	•
JAM RIVETS, 7/8" capacity	1	1	1	1	2	1	3	2	4	3	8	5	•	•	•	•	•	•
SHORT JAM RIVETS, 1 1/8" capacity	1	1	1	1	2	1	3	2	4	3	8	5	•	•	•	•	•	•
COMB. JAM RIVETS, 3/4"	3	2	4	3	5	4	9	6	13	9	24	16	•	•	•	•	•	•
RIVET BUSTER up to 7/8" capacity	2	1	3	2	4	3	7	5	10	7	17	13	•	•	•	•	•	•

MORE ON NEXT PAGE →

CONTINUED FROM PREVIOUS PAGE

COMPRESSOR CAPACITY, cfm	60		85		105		160		210		315		365		420		500	
AIR PRESSURE, psi	70	90	70	90	70	90	70	90	70	90	70	90	70	90	70	90	70	90
CALKING AND CHIPPING HAMMERS																		
1" str., medium chipping			6	4	7	5	11	8	15	12	22	17	•	•	•	•	•	•
2" str., medium and heavy chipping	4	3	6	4	7	5	11	8	15	12	22	17	•	•	•	•	•	•
3" str., heavy chipping	4	3	6	4	7	5	11	8	15	12	22	17	•	•	•	•	•	•
3" str., general chipping	3	2	5	4	8	5	14	9	15	10	27	18	•	•	•	•	•	•
Light calking and scaling	6	4	8	6	13	8	2	15	30	20	45	32	•	•	•	•	•	•
Light and medium calking and scaling	5	4	7	5	9	7	16	12	19	14	28	21	•	•	•	•	•	•
SCALING TOOLS																		
Light duty and boiler scaling tool	9	7	15	10	20	12	33	22	31	22	•	•	•	•	•	•	•	•
Heavy duty scaling hammer	11	8	17	10	25	15	40	26	40	23	•	•	•	•	•	•	•	•
GRINDERS																		
Die grinder	8	7	13	11	16	14	25	21	32	28	•	•	•	•	•	•	•	•
Grinder 2" diameter wheel cap.	3	2	4	3	5	4	8	7	11	9	16	14	•	•	•	•	•	•
Grinder 6" diameter wheel cap.	2	2	3	2	4	2	6	4	8	7	12	10	•	•	•	•	•	•
Grinder 8" diameter wheel cap.	1	1	1	1	3	2	4	3	6	5	10	7	•	•	•	•	•	•
Wire brushing machine 8" radial brush capacity	1	1	1	1	2	2	4	3	6	4	10	8	•	•	•	•	•	•
For squaring shanks on rock drill steels	2	2	3	2	3	2	4	3	8	6	14	10	•	•	•	•	•	•
GRINDERS																		
5" cup wheel or 7" sanding pad cap.	1	1	1	1	2	1	3	2	5	3	8	6	•	•	•	•	•	•
6" cup wheel or 9" sanding pad cap.	1	1	1	1	3	2	3	2	5	4	9	7	•	•	•	•	•	•
DRILLS, drilling, reaming, tapping,																		
Heavy duty drilling machine up to ⅜" capacity	4	3	6	5	7	6	14	11	20	15	•	•	•	•	•	•	•	•
Drilling and reaming up to ⅞"	2	2	3	2	5	3	7	5	10	8	•	•	•	•	•	•	•	•
Close quarter drilling and reaming machine up to 1-1/16"	2	2	3	2	5	3	7	5	10	8	17	13	•	•	•	•	•	•
Machines up to 1¼"									5	4	7	6	•	•	•	•	•	•
Machines up to 2"									2	2	4	3	•	•	•	•	•	•
Drilling and reaming machines up to 1¼" cap.	1	1	1	1	2	1	3	2	4	3	8	5	•	•	•	•	•	•
Machines up to 2" cap.					1	1	2	1	3	2	4	4	•	•	•	•	•	•
WOOD BORERS																		
Wood boring machines up to 1" cap.	2	2	3	2	5	3	7	5	9	8	17	13	•	•	•	•	•	•
Up to 4" capacity	1	1	1	1	2	1	3	2	4	3	8	5	•	•	•	•	•	•
TORQUE WRENCHES																		
Right angle nut running machines up to ¾" bolt cap. torque type	3	2	3	2	5	3	7	5	10	8	17	13	19	15	22	16	27	21
REVERSIBLE NUT RUNNING MACHINE IMPACT TYPE																		
Cap. up to ⅜" bolt size nuts	4	3	6	5	8	6	13	10	•	•	•	•	•	•	•	•	•	•
Up to ⅝"	3	3	4	3	5	4	9	7	14	11	•	•	•	•	•	•	•	•
Up to ¾"	3	2	4	3	5	4	8	6	14	10	•	•	•	•	•	•	•	•
Up to 1¼"	2	1	3	2	3	2	5	4	8	6	•	•	•	•	•	•	•	•
Up to 1¾"			1	1	1	1	2	2	3	2	5	4	6	4	7	5	8	6
PORT. CIRC. SAW 12" BLADE	1	1	2	2	3	2	6	4	9	6	15	10	•	•	•	•	•	•
CONCRETE VIBRATORS																		
Light duty conc. vibrator	2	2	3	2	5	4	9	7	13	9	20	15	•	•	•	•	•	•
Medium, heavy duty	1		1	1	1	1	3	2	5	3	7	5	8	6	9	7	•	•
PORT. SING. DRUM HOISTS																		
Cap. up to 2000 lbs. pull slow rope speed on single line			**1		**1		**2		**3		**5		**6		**6		**6	
High rope speed									**1		**1		**2		**2		**2	
Up to 3500 lbs.											**1		**1		**1		**1	
HEAVY DUTY BACKFILL-TAMPING MACHINE	3	2	5	3	6	4	19	6	14	9	22	16	•	•	•	•	•	•
SUMP PUMP																		
Port. centrifugal type low heads			1		1	1	2	2	3	2	5	4	5	4	6	5	8	7
Two tandem connected pumps higher heads							1	1	2	1	2	1	3	2	4	2	•	•
Port. centrifugal type high heads							1	1	1	1	2	2	3	2	2	2	•	•

WATER WEIGHS 8.34 LB PER GAL.

In the first example of the December Plant Engineer's Handbook the factor 8.34 should be used to determine the weight of water in the tank. A typographical error appears in the second equation. It should read:

$$A = \frac{C \times V}{B \times 2.4}$$

Our thanks to A. P. Edwards, Nash-Kelvinator Corporation.

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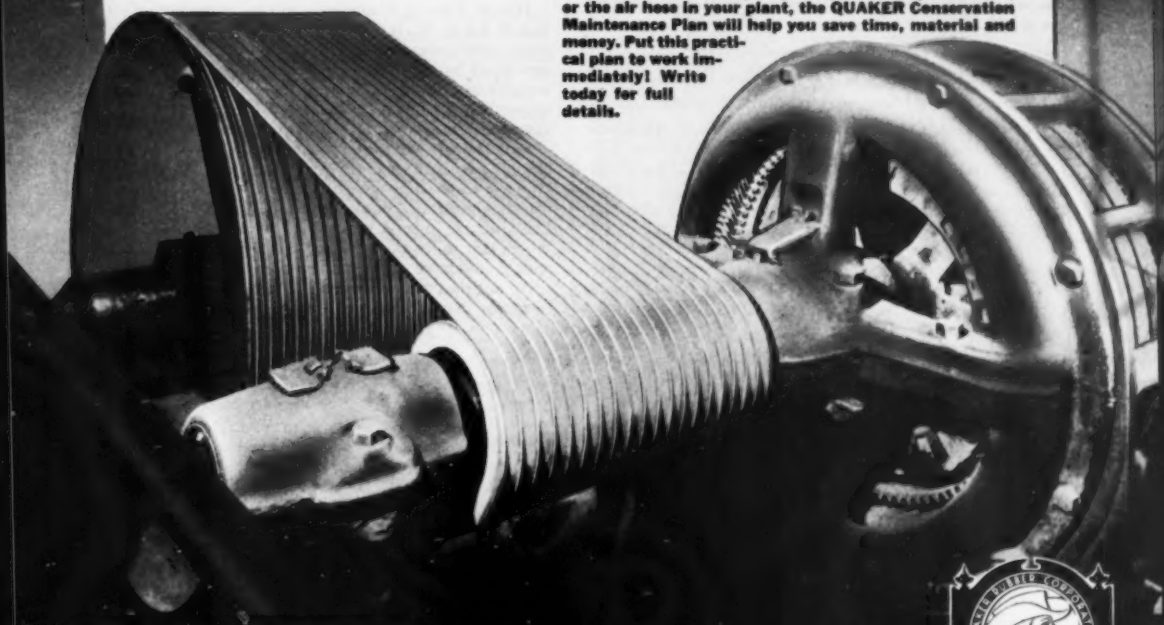

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Spot News

Short, "boiled-down" paragraphs on the most interesting recent events and developments in American industrial plants.

All-Aluminum Swing Line Expedites Tank-Car Filling and Lessens Work

The engineering staff of the Ohio Oil Company has a long list of improvements in production facilities and procedures to boast about. Recently, at the firm's 30,000 bbl per day refinery near Robinson, Ill., the filling of tank cars was expedited and worker fatigue lessened by the use of a newly designed all-aluminum swing line.

The line is 12 ft long, 4 in. in diameter, fabricated with Tube-Turn aluminum welding fittings, and counterweighted. The discharge end of the line is equipped with a Tube-Turn tee, so that the oil is directed to both ends of the tank, adding considerably to filling efficiency.

Weight of the all-aluminum assembly is approximately 42 lb. Had it been fabricated in the conventional way, with carbon steel pipe and fittings, it would weigh approximately 129 lb and would require correspondingly greater physical effort to maneuver.

The aluminum pipe and fittings used in the new swing line are of 3S-F alloy. The joints were welded by the argon gas shielded tungsten arc method.

Boom Stacker and Wharf Hoist Are Features Of Dock-Side Materials-Handling System

Illustrated below are the wharf unloading hoist and boom stacker incorporated in the conveyer system installed at the Warners plant of American Cyanamid Company for handling bauxite and sulfur. This system, described fully in the January issue of INDUSTRY AND POWER, pages 80, 81 and 82, was completed a few months ago. It has a capacity of 672 tons an hr and utilizes 640 ft of conveyer belting to centralize storage of raw materials close to the dock area; it replaced a 1,580-ft conveyer of 300-ton capacity that carried sulfur to a storage pad in the center of the plant's working area, thereby creating a considerable dust problem.

Engineers of the Derrick & Hoist Company, Inc., through the representation of its president, Joseph Obstler, collaborated with engineers from the Warners plant and American Cyanamid's central engineering department to design and develop all the new features entering into the construction of the sulfur and bauxite unloading tower and the hydraulically operated boom stacker.

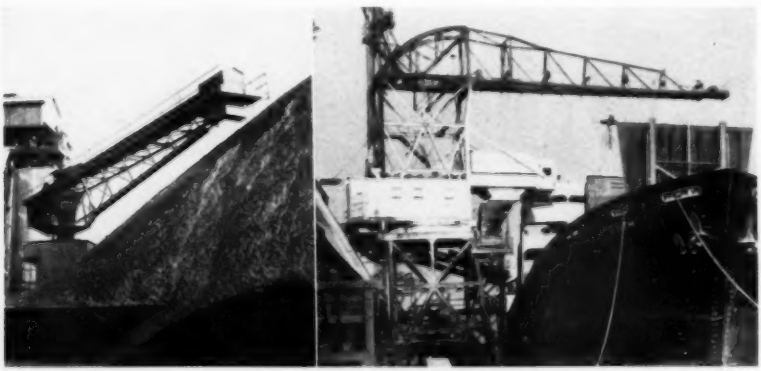
In designing and building the remaining elements in the conveyer system, American Cyanamid's central engineering department was assisted by a number of other firms including the General Electric Company; Superior, Mundy, Lidgerwood Company; S.K.F. Industries, Inc.; Jeffrey Manufacturing Company; Fawick Airflex Company; and Hydraulic Press & Manufacturing Company.

Chemical Plant Protected By Automatic Continuous Sampling of Combustible Gases

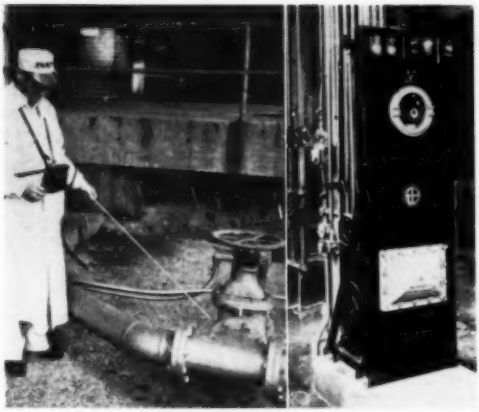
Hunter Packing Company's solvent extraction plant at East St. Louis. Ill., is protected against explosions by a multipoint continuous-sampling combustible-gas alarm system developed by the Mine Safety Appliances Company. Air samples from eight locations in the plant are analyzed continuously, the samples being aspirated at each location by an instrument incorporating a turbo-compressor vacuum pump.

Sample lines from the aspirators lead to the MSA combustible-gas alarm, where the gases are continuously analyzed. When a combustible concentration is detected, the instrument automatically warns by red light and audible signal. Exact trouble spot is pin-pointed by an annunciator light system that shows the sampling line from which the sample with combustible concentration was taken.

Among the many safety precautions adopted in this solvent extraction plant is extensive testing of all areas before repair



Hydraulic boom stacker (left) and wharf unloading tower (right) are major elements in 672-ton capacity conveyer system installed at Warners plant of the American Cyanamid Company for handling bauxite and sulfur. Movement and storage of these raw materials are centered at the dock area to reduce dust problems to a minimum



Left: Portable unit detects combustible gases before repair work is started. Right: Panel where samples are analyzed continuously; red light and audible signal warn when concentrated combustible gases are detected

work is started. In these tests, a portable MSA Explosimeter is employed, as demonstrated in the accompanying illustration, to detect instantly any combustible concentrations of gases or vapors.

Fire and Machinery Damage Prevented By Magnets in Cotton Fibre Plant

Seventeen Eriez Alnico plate magnets have been installed in the Los Angeles plant of the National Automotive Fibres Co. as protection against fire and textile machinery damage. The company is engaged in the manufacture of cotton felt upholstery and automotive pads.

Each magnetic separator is installed above a spiked apron feeder which feeds cotton linters in garnett machines at the rate of about 350 lb per hr. The non-electric magnets catch any stray iron that may be mixed with the cotton before the metal has a chance to strike the machinery.

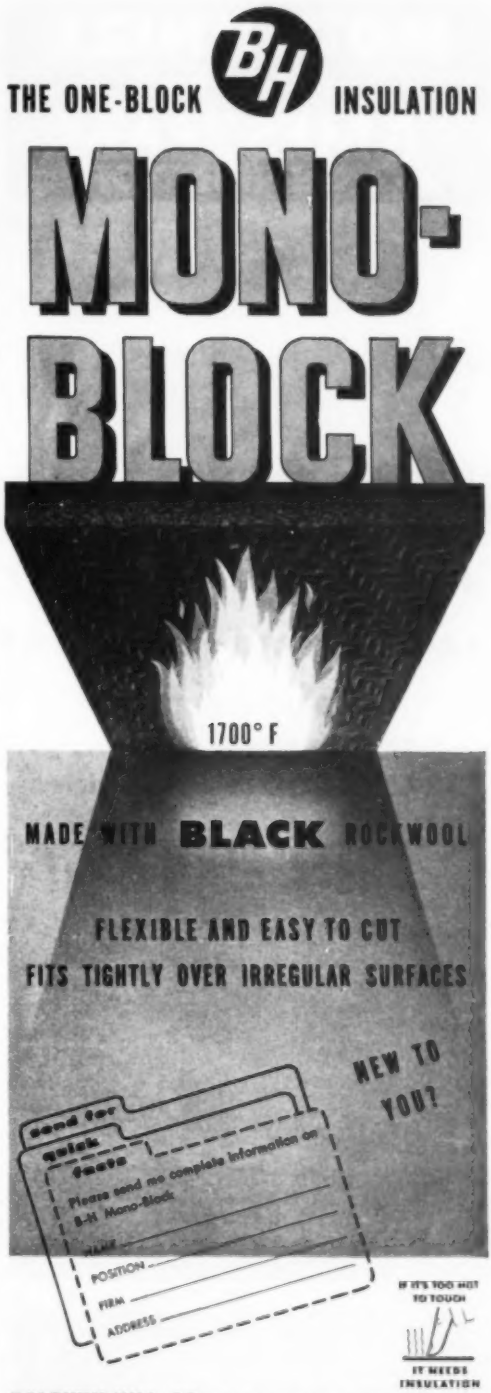
The magnetic separators are made by the Eriez Manufacturing Co., Erie, Pa., of Alnico V metal, an alloy of aluminum, nickel, and cobalt. Alnico retains magnetism indefinitely without the use of electricity.

Water Cooling Equipment Manufacturers Organize Institute to Conserve Water

The practical encouragement of all efforts, both governmental and private, toward the conservation of water as America's number one natural resource has been announced as the primary objective of the newly-formed Cooling Tower Institute, according to Raymond C. Kelly, president.

Other objectives of the Institute, representing the majority of the manufacturing capacity for industrial-type water-cooling equipment, will be to support cooperative research toward improving the technology, design, and performance of industrial water-cooling equipment; to coordinate recognized engineering groups in developing standardized testing procedures acceptable to manufacturers, users and technical groups; to establish minimum standards of construction; and to accumulate technical data of interest to both manufacturers and users of industrial water-cooling equipment.

The seven charter member companies and their present



MODERNIZE
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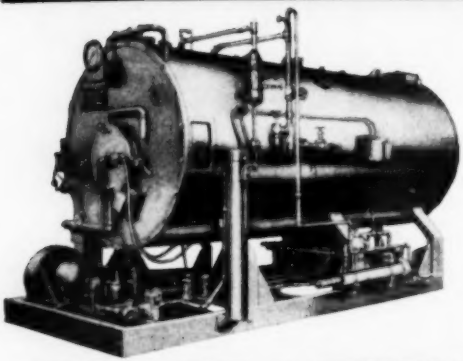
GENERATOR



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Serving with President Kelly are: Mr. Fluor, first vice-president; Mr. Brown, second vice-president; and Mr. Mart, secretary-treasurer.

Demonstration Pipeline Will Be Built To Transport Coal

A few weeks ago the Pittsburgh Consolidation Coal Company announced plans to build a demonstration-size pipeline system for the transportation of coal. It will be located near Cadiz, Ohio, at the site of the Georgetown surface-mining operation of the Hanna Coal Company Division. The company's announcement of the project stated:

"This pipeline project was begun by the Research & Development Division in 1949 after making studies of work done on the movement of coal by pipelines by other companies here and abroad over the past 50 years.

"Early last year a small pilot operation was developed at Library, Pa., and experimental work has been under way at these facilities for several months. Development of the system has advanced as far as the present small pilot facilities will permit; hence, the decision to build a full-scale demonstration pipeline system at a cost of about $550,000. This full-scale pilot pipeline project represents the final stage in the company's investigation of this method of transporting coal from mine to market.

"The new pilot project will consist of a 12-in. pipeline about 17,000 ft long, special coal crushing and 'slurry' preparation equipment, and specially designed pumps which the company has developed for this purpose.

"Preparation of the coal will include washing and crushing to fine sizes, then mixing with water to form a slurry. This slurry will be fed into the system and moved through the line under pressure by means of the special pumps. Equipment will be installed at the destination end of the pipeline system to remove the coal.

"The pipeline will be completely instrumented so that all pertinent engineering data can be documented. When completed, the pipeline system will be operated continuously and will handle several thousand tons of coal daily.

"Materials and equipment for the project have been purchased and the new pilot facility will be constructed as soon as weather permits this Spring. Engineering work on the project is being done by Allen and Garcia Company of Chicago."

Radiant Heaters Give Improved Product And Lower Manufacturing Costs

When gas-fired convection ovens proved unsatisfactory for heating molds used to compress fibrous kapok into solid cores for regulation softballs, the plant engineer in a midwestern factory replaced the ovens with radiant heaters. The latter were mounted vertically around a chain conveyer carrying the molds. The metal molds are heated to 300 F in approximately 20 min during one pass through the conveyer.

The installation is shown in the accompanying illustration. An open vertical oven utilizes four Chromalox radiant heaters, built by the Edwin L. Wiegand Company. The heaters are used in two groups, mounted facing the conveyer chain with metal molds inserted.

Continuous production, faster than batch production re-

Radiant heaters at chain conveyer cut production costs by bringing metal molds to 300 F in 20 min

quired with the replaced convection ovens, reduced manufacturing costs. Of equal, if not more importance was an improvement in the product: increased amounts of kapok were permitted and less cord was used, which resulted in a livelier ball.

Worth of WC4 Cast Steel in Valve Service Emphasized at ASME Meeting

A technical paper recently presented by T. N. Armstrong and R. J. Greene before the American Society of Mechanical Engineers cited the worth of nickel-chromium-molybdenum cast steel (WC4), a development of The Lunkenheimer Co. of Cincinnati, Ohio, in valve service under severe operating conditions.

Messrs. Armstrong and Greene are affiliated with the International Nickel Co., Mr. Armstrong in the development and research division and Mr. Greene in the research laboratory.

WC4 Steel, an alloy especially resistant to graphitization, was developed by Lunkenheimer's research division.

Largest Medium Gas-Filled Cable Described To American Institute of Electrical Engineers

Details of the largest medium gas-filled cable ever constructed for operation above 46 kv were described at the winter general meeting of the American Institute of Electrical Engineers in New York City last month. The paper was presented by H. W. Clark of the Potomac Electric Power Co., Washington, D. C.

Because of airfields, park territory, populous areas, and the fact that available routes were preempted by other utilities, overhead transmission was impractical at the company's new plant near Alexandria, Va. Medium-pressure, gas-filled cable at a cost of $9.73 per kva was chosen because it

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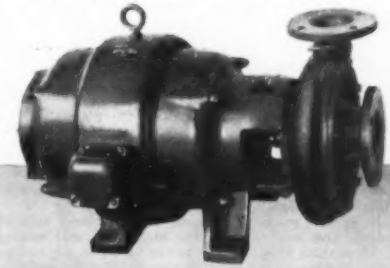
Why not talk Pumps with WEINMAN? WEINMAN'S knowledge will save you money and worry. The WEINMAN representative is ready to talk facts and figures whenever, wherever you say. Just write, wire or phone.



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The WEINMAN Pump Mfg. Co.

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Now, with this new Versene* water hardness testing kit you can determine the hardness of your own boiler, process or tap water as easy as ABC—in less than 2 minutes. Anyone who can tell red from blue can make this scientific versenate test and be accurate within one grain of hardness per gallon.

Handy, sturdy, pocket-size plastic kit contains 3 vials of chemicals and one combination measuring and mixing vial. More than 50 separate tests can be made, depending on water hardness. Complete instructions. Refills available.

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We also manufacture and supply Inhibited Indicator and Di Sodium Versenate (the di sodium salt of ethylene diamine tetra-acetic acid). These are the reagents used in the Versenate (Schwartzenbach) Method for the determination of Water Hardness.

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50 g. $2.00 100 g. $3.00 500 g. $10.00
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DEPT. G, FRAMINGHAM, MASSACHUSETTS
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would have smaller diameter and less weight than other available cables, its electrical characteristics were satisfactory, its life expectancy great, and it offered greatly reduced operating and maintenance costs.

Diesel-Powered Pump Serves As Standby Water-Supply Unit

There's little chance of finding a dry water tap in Lincolnton, N. C., with the illustrated pumping unit standing by. It occupies small space but provides plenty of power to safeguard the town's water supply in case of emergency.

This unit, also used as standby water-supply equipment

Diesel-driven pump cuts in when normal water supply fails. Remotely located pushbutton starts the unit

in industrial plants, consists of a six-cylinder General Motors diesel engine driving a Dayton-Dowd pump. Remotely controlled by push-button, it is operated 1 hr each day to assure availability whenever needed.

Celebrates Fiftieth Year As Builder Of Materials-Handling Equipment

In 1951 the Stephens-Adamson Manufacturing Company marks its fiftieth year in the production of materials-handling equipment at its Aurora, Ill., plant. The company began operations in a single 80x120-ft building in June, 1901, and today occupies a 13-acre site with 230,000 sq ft of plant space. Branch plants are located in Los Angeles, Calif., and Belleville, Ontario, Canada, while sales offices are located in principal U.S. cities and throughout the world.

Through the past fifty years, Stephens-Adamson has made many important contributions to progress in the materials-handling field. In 1907, the company equipped the first commercially successful self-unloading bulk freight boat on the Great Lakes. That same ship is still in service today, along with a large fleet of others similarly equipped by S-A.

By 1910, in recognition of the pressing need for high-capacity equipment, S-A had built a bucket elevator rated at 1,000 tons per hr. It has been handling a million tons a year ever since. Anti-friction, ball bearing equipped, belt conveyer carriers were introduced by S-A in 1911 to overcome the excessive power demands of early belt conveyers.

Patents were issued to S-A in 1914 covering a pivoted bucket conveyer with an automatic turnover bucket, which insured complete and controlled discharge. By 1922, the company had refined its belt conveyer carrier design to the point where they were ready to engineer the first long belt conveyer system. A specially designed carrier was used in a 4-1/3 mile belt conveyer installation carrying coal underground from mine to barge loading dock. This system, which

has been extended several miles, is still in operation and operating engineers expect an additional 15 or 20 years of service from the original machinery.

The Amsco manganese steel feeder was first marketed by S-A in 1924 and has since been installed in almost 90 per cent of all western metal mines. A large ore processing plant had almost 50 of these heavy-duty units in operation by 1929, and to date there is no record of any Amsco feeder wearing out, or being seriously damaged while in operation.

Another S-A "first" was the centrifugal box-car loader introduced in 1927. This unit has revolutionized loading methods for bulk materials shipped in box cars and has been adapted for many special applications, both fixed and portable. Mounted on gantries at dockside, these units are loading and trimming ships in ports throughout the world.

In 1929 the company engineered and built the conveying and screening equipment for one of the country's largest limestone plants. Huge traveling stackers discharge belt conveyers, forming long storage piles of various sizes of crushed stone. Tunnel conveyers under the piles recover the stone at a rate of 4,000 tons per hr.

Stephens-Adamson introduced the "en masse" Redler conveyer in 1932, finding a tremendous demand in the chemical and food industries.

Another S-A development in the early "thirties" was the circular bin discharger. This unit is designed to unload materials, which tend to arch over bin openings, or aerate and flow out too rapidly. A large chemical plant has 75 of these dischargers in operation, guaranteeing a steady flow of material to the conveying system.

Long aware of the importance of good bearings in improving conveyer performance, S-A began producing its own bearings in 1938. The Sealmaster ball-bearing unit is now produced in a modern plant completed in 1946 and is used not only on all S-A machinery, but distributed throughout the world.

The zipper conveyer was introduced in 1944 and offers extreme layout flexibility, along with gentle handling. This rubber belt forms an endless tube when closed, and carries material vertically and on inclines, as well as the horizontal.

Seven Point Program Urged to Attain Rubber Security in U. S.

On the basis of the National Defense Program for 1951, the rubber industry should be able to supply all military and essential civilian rubber product needs in the coming year without alarming shortages, John L. Collyer, president of the B. F. Goodrich Co., Akron, O., told National Association of Independent Tire Dealers, Inc., convention. The nation's economy will be on a wartime, or a preparation-for-emergency basis for a long time, he pointed out in advocating a seven-point program to attain rubber security as soon as possible for the United States.

President Collyer's recommendations called for: (1) Rapidly increasing output of American rubbers up to 920,000 tons; (2) Increased usage of American rubbers as rapidly as they are available; (3) Addition of excess American rubber to government's working inventory, as protection against damage or dislocation of industry; (4) Government exchange of American rubbers with foreign countries for crude rubber; (5) Government efforts to prevent sale of crude rubbers to Russia to insure that our present limitation program will make crude rubber available to our own strategic stockpile; (6) Government to accumulate crude rubber only to extent justified by careful study of probable military and civilian needs for an extended emergency; and

(Continued on page 144)

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"POWDER-PACKED" FUSES
Save
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CUT MAINTENANCE COSTS
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The ONLY fuse with a "Custom-Built" . . . "Powder-Packed" renewal element that provides:
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CAPACITY OPERATION *Easily*

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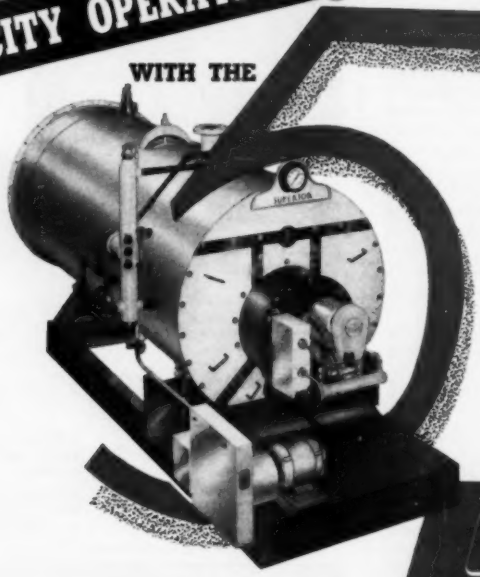

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Superior Steam Generators are completely factory assembled, backed by undivided responsibility. Burn gas or oil, or both. Manufactured in 18 sizes from 20 to 600 b.h.p. for pressures up to 250 p.s.i. or for hot water.

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readers' guide to advertised products

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AIR & DUST FILTERS & COLLECTORS

500—See page 57. Electrical Precipitation: Write for your free copy of an informative booklet which presents full information on the Cottrell Precipitator. It effectively cleans stock gases by removing over 95% of all fly ash particles. Research Corporation.

ANTI-CORROSIVE & PROTECTIVE COATINGS

501—See page 23. Rust Preventive: Rust-Oleum seals metal so that no rust-causing oxygen can reach it. Available in a full range of colors. Write for complete catalog. Rust-Oleum Corporation.

BOILERS & BOILER ACCESSORIES

502—See page 138. Firebox Type Boilers: Especially adapted for high pressure—10 to 304 hp, 100, 125, 150 lb wp. Send for full information and free 6 in. scale with pipe diameter markings. Kewanee Boiler Corp.

506—See page 17. Baffles: Enco streamlined baffles give you 4 major values—better heat transfer; low draft loss; less steam and time for cleaning; custom installation. Write for Bulletin BW44 for full details. The Engineer Company.

507—See page 141. Heating Specialists: Every day more than 750, oil and gas fired, Petro-Chem Iso-Flow installations in the petroleum, chemical and allied industries, demonstrate the efficiency of their design and installation. Write for full details. Petro-Chem Development Co., Inc.

BUILDING HEATING, VENTILATING & AIR CONDITIONING

508—See page 3. Unit Heaters: Trane unit heaters now feature a new, completely adjustable Louver Fin Diffuser for an infinite number of diffusion pattern possibilities. Write for additional information on this new easy way to control air flow. Trane Company.

509—See page 143. Air Conditioning: Niagara "Controlled Humidity Method" uses little or no mechanical refrigeration for dehumidifying. Saves space, maintenance expense, power. Write for Bulletin 112. Niagara Blower Co.

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510—See page 145. Free Repair Handbook: 40 pages describing Smooth-On repairs that can save you time and money. 170 illustrations. Write for your free copy now. Smooth-On Mfg. Co.

511—See page 131. Instant-Use Floor Patch: Tough, plastic material which restores broken concrete to solid smoothness. Run traffic over it immediately. Write for details of free trial offer and "Handbook of Building Maintenance". Flexrock Co.

512—See page 49. Aluminum Jacketing: Write for complete literature on the new low-cost jacketing engineered especially to protect outdoor lines in refineries and chemical plants. Childers Manufacturing Co.

513—See page 114. Check This Economy Move: Over 1900 firms supply more than 33,000 products which Hajoca stocks for industry. Use this one source and eliminate your high cost of dealing with many sources of supply for the industrial products you use. Hajoca Corp.

COAL ASH & BULK HANDLING

514—See page 66. Bulk Materials Handling Systems: Stephens-Adamson engineers are at your service to solve your bulk materials handling problems quickly and economically. Write today. Stephens-Adamson Mfg. Co.

To: INDUSTRY AND POWER, St. Joseph, Michigan **March, 1951**

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Advertised Products Numbers begins Page 117	*New Equipment Numbers begins Page 11*	*New Bulletin Letters begins Page 24*

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Your Company_____

Co. Address (St. & No.)_____

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515—**See page 127. Electric Vibrators:** If you have a troublesome bin or hopper write the details to Syntron. Their Engineering Department will be glad to give you their recommendations without obligation. Syntron Co.

516—**See page 60. Bucket Elevators:** Newly designed, they give you welded angle casings of heavy gauge steel that are dust and water tight; better head and boot sections; more bearing protection; removable hood; large clean-out and inspection doors. Write for full information. The Jeffrey Manufacturing Company.

517—**See page 123. Belt Conveyors:** The only organization offering you complete belt conveyor "package": engineering, specialized machinery and belting. Whenever the handling of bulk materials is your problem, you are invited to submit your problem concerning the handling of bulk materials without obligation. Hewitt-Robins Incorporation, Robins Conveyor Division.

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520—**See page 115. Floatless Level Control:** Send for your copy of the new leaflet that presents this new floatless level control for boilers, tanks, evaporators, heaters, standpipes, etc. Leslie Co.

521—**See page 131. Regulators:** Valve-in-end construction gives you simple, compact design built for maximum performance. Stets Type G are setting new efficiency records daily. Write today for Bulletin 150. Stets Company.

522—**See page 54. Portable Voltmeter:** Write for full details on Model 901 d-c portables, designed to bring you Weston's concept of the finest general purpose portables ever produced. Weston Electrical Instrument Corp.

523—**See page 145. Temperature Regulators:** Write for Stacon Bulletin 50-1000 for full details on extra sensitive, accurate, economical temperature regulators. Farris Stacon Corporation.

524—**See page 62. "Combustion Guide" Instruments:** These bulletins now available at no cost: 30-849 contains data on the Magnotherm O_2 Meter, Condu-therm CO_2 Meter and the Hays Combustion Meter; No. 30-550 gives you full data on Hays-Penn Boiler Efficiency Meter. The Hays Corporation.

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528—**See page 103. Temperature Control:** Spence Temperature Regulators reduce the steam pressure and also accurately modulate flow as required to control temperature. For complete details on the entire Spence line of automatic regulating valves, strainers and desuperheaters, write for Bulletin 1200. Spence Engineering Co., Inc.

529—**See page 136. How To Reduce Thermocouple Cost:** For complete information on either Repairs and Reclaiming or New Couples, fill out coupon on page 136 and mail today. If you prefer, use this item number on the Reader Service card to obtain free copy of Engelhard Bulletin 330-D. Charles Engelhard, Inc.

530—**See page 142. Temperature Recorders:** Precision-built for your specific needs. Low-cost protection. Send for catalog showing Auto-Lite Temperature Recorders and Indicators. The Electric Auto-Lite Company.

(Continued on page 120)

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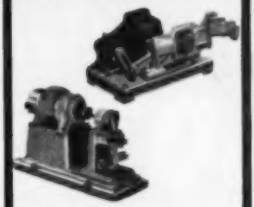

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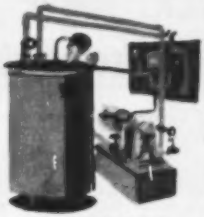

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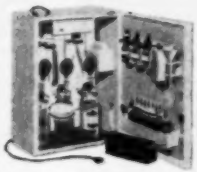

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readers' guide to advertised products

(Continued from page 118)

CRANES & HOISTS

531—See page 128. Unloading Tower and Boom Stacker: Write for more information on these two important "Firsts": push button operated bucket unloading revolving tower-crane with pivoted boom; self-contained hydraulically operated boom stacker. Derrick & Hoist Co., Inc.

532—See page 145. Krane Kar: Gasoline powered. Works inside and outside your plant. Handles loads at front or sides. Don't wait to get more information. Ask for Bulletin No. 79 or for a Sales Engineer. Silent Hoist & Crane Co.

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533—See page 132. Hydryer: Pritchard hydryers are standard packaged units designed to reduce dew points of compressed air and other gases to minus 40° F. Write for free Bulletin No. 16.0.080. J. F. Pritchard & Co.

ELECTRICAL DISTRIBUTION

534—See page 48. Renewable Fuses: You are invited to write for latest catalog for more information about "Economy Delay" Renewable Fuses, which give safe protection where most overloads occur—in the 135 to 200% range. Economy Fuse and Mfg. Co.

535—See pages 14, 15. Fusetrons: A fuse to which is added a thermal cutout offers large time-lag and less electrical resistance. Fits standard fuse blocks and may be used throughout entire electric system. Send for complete facts about Fusetron Dual-Element Fuses. Bussmann Mfg. Co.

536—See pages 32, 106. I-T-E Switchgear: If you have any questions on modern HV switchgear construction, send for Bulletin 7000-A on I-T-E's newest 5KV Switchgear. Also request Bulletin 6003-D, a complete reference guide to I-T-E 600V Switchgear assemblies. I-T-E Circuit Breaker Co.

537—See page 115. Fuses and Clamps: Write for Bulletins No. 1 and 6 describing "Kliplok" clamps that eliminate damage to electrical equipment and unnecessary shutdowns, and "Powder-Packed" renewable fuses that provide temper-proof protection. Trico Fuse Mfg. Co.

538—See pages 40, 41. Stabiline Voltage Regulators: See pages 40, 41 for handy coupon. Request your copy of Bulletin S351 containing technical data on Stabiline Automatic Voltage Regulators. The Superior Electric Co.

FUELS & FIRING EQUIPMENT

539—See page 25. Fanmix Burners: Bulletin 410-6 will give you complete data on Coppus-Dennis Fanmix Burners that increase boiler ratings with your present furnace and stack. Write today. Coppus Engineering Corp.

540—See page 55. Perfect Spread Stoker: Compact, fully-protected mechanism runs quietly without clogging. You can use the coals that are attractively priced in your locality. See page 55 for handy coupon which will bring you full information about Perfect Spread Stokers. American Engineering Company.

541—See pages 18, 19. RotoStoker: See pages 18, 19 for important highlights of the Detroit RotoStoker installation at Hanes Dye & Finishing Co. You are invited to write for your copy of the complete Hanes Story. Detroit Stoker Company.

ENGINES

542—See page 33. Steam Engines: Cut your power costs by putting steam fully to work. Use exhaust from the Troy-Engberg Steam Engine for your processing or heating, or both. Send for your copy of Bulletin 306. Troy Engine & Machine Co.

LUBRICANTS, LUBRICATION, OIL FILTERS & PURIFIERS

543—See page 27. 11 Ways to Cut Production Costs: Write for your copy of this free, new booklet which is yours without obligation. You will find handy coupon on page 27. Alemite Div., Stewart-Warner Corp.

544—See page 144. Lubricating Oil Purifiers: The Hilco line of purifiers, reclaimers and filters offers complete recovery service for all types of lubricating and industrial oils. Write for free literature. The Hilliard Corp.

545—See page 51. Colloidal Graphite: Write for Bulletin 426-17C on "dag" colloidal graphite for general lubrication, extreme temperature lubrication, parting, impregnation, and opaquing. Acheson Colloids Corporation.

546—See page 142. Non-Fluid Oil: Send for instructive bulletin and free testing sample of Non-Fluid Oil for positive bearing protection. New York & New Jersey Lubricant Company.

547—See pages 35, 36. Turbine Oil: Write for full information on Nonpareil Turbine Oil. Low-acidity operation eliminates need for treating oil or cleaning turbine oil systems—expert, personal service by Standard Oil lubrication specialist available, too. Write for full information. Standard Oil Company (Indiana).

MATERIALS OF CONSTRUCTION

548—See page 44. "S" Monel: One of the hardest and strongest of the nonferrous casting alloys offering extra hardness at elevated temperatures, pronounced resistance to galling and seizing, and excellent corrosion resistance. See page 44 for typical applications. Additional engineering data available upon request. The International Nickel Company, Inc.

MECHANICAL POWER TRANSMISSION

549—See page 47. Multi-V-Drives: Advertisement describes 5 features to look for when buying V-belt drives. Write for bulletin No. V1400B7F for full details on Worthington Multi-V-Drives and QD Sheaves. Send coupon today. Worthington Pump and Machinery Corporation.

550—See page 67. V-Belts: When you buy V-belts, be sure to specify Gates Vulco Rope—gives you the money-saving "concave side" feature. Write for details. The Gates Rubber Company.

For your free copies of this new literature and more data on advertised products, list the key numbers of the descriptive paragraphs on one of the handy order cards on p. 117. Mail today—postage-free!

551—See pages 8, 9. Dayton Cog-Belts: Put cost-cutting teeth in your V-belt drives. Dayton Cog-Belts mean 40% more horsepower per belt, fewer pulley grooves, fewer belts, and longer belt life. Complete data and cost information upon request. Dayton Rubber Company.

OFFICE EQUIPMENT

552—See page 140. Portable Photo-Copier for Industry: Copies anything anywhere. Truly portable for utmost convenience. Saves time and money. Simple to operate. Write for your free folder describing the new "Contoura" photo-copier. F. G. Ludwig Associates.

PACKAGED STEAM GENERATORS

553—See page 116. Packaged Steam Generators: New, fully illustrated Catalog 302 gives complete details for units available in 18 sizes. Write today. Superior Combustion Industries, Inc.

554—See page 53. Steam-Pak Generator: Steam-Pak Generators are built in capacities from 15 hp up, for low or high pressure, steam or hot water, for light or heavy oil, combination gas and oil, or straight gas. Write for complete data. York-Shipley, Inc.

555—See page 112. Amesteam Generator: Dependable, quick steaming unit. Minimum installation expense, economical operation. Write for latest free bulletin. Ames Iron Works.

503—See page 63. Cleaver-Brooks Steam Boiler: Available in sizes 15 to 500 hp, 15 to 500 lb psi. Write for your copy of the Cleaver-Brooks steam boiler catalog—interesting, informative, beautifully illustrated. No obligation. Cleaver-Brooks Company.

504—See page 39. Cost-Saving Steam Generators: Powermaster is a completely equipped steam plant, available in sizes from 15 hp up. You can burn light oil, heavy oil, gas or a combination of these three fuels. Wired, piped, insulated and tested at the factory. Get complete information by sending for the latest Powermaster Catalog. Orr & Sembower, Inc.

505—See page 7. Keystone Generator: 2-drum water tube boiler, automatic oil and gas burner, induced draft fan, operating and safety controls. Easily cleaned—nationally serviced. Write for Bulletin SB-38. Erie City Iron Works.

PACKINGS & GASKETS

556—See page 130. Quality Packings: Outstanding quality and maximum service is the insurance you get with "John Crane" line of packings. Write for complete details. Crane Packing Company.

557—See page 134. Flange and Joint Sheet Packing: Write for Bulletin SP-19—the single sheet with eight perfect answers to all sheet packing and gasket requirements. Greene, Tweed & Co.

PIPE & FITTINGS

558—See page 30. Ball-Bearing Swivel Joints: Catalog No. 50 gives full information on more than 500 different types, styles and sizes Chiksan Ball-Bearing Swivel Joints. Write today. Chiksan Company.

559—See page 65. Flexible Metal Hose & Tubing: Write today for Bulletins SS 50 and CC 300 for more data on these flexible connectors for almost any liquid, gas or semi-solid. American Metal Hose Branch, The American Brass Company.

560—See page 135. Flexible Ball Joints: Ask for your copy of the new Catalog No. 215 "Barco Flexible Ball Joints".

readers' guide to advertised products

Barco factory and field engineers are ready to help you solve your problems without obligation. Barco Manufacturing Co.

561—See page 145. Flexible Metallic Hose: "Atlantic" metal hose survives most extreme conditions. Seamless or interlocking, in bronze, steel, stainless steel, monel. Write for Catalog 500. Atlantic Metal Hose Co., Inc.

PUMPS

562—See page 146. Single Rotary Pump Unit: For fast loading and unloading of gasoline, fuel oil or Diesel fuel, write for free Bulletin SP-223AG today. Viking Pump Co.

563—See page 64. Pumps: Now with the new "Warren-Quimby" combination, you have two outstanding names in one giving you maximum service for your pump requirements. Write for complete information. Warren Steam Pump Company, Inc.

564—See page 113. Weinman Pumps: They work at maximum efficiency on every job. If your plant handles liquids in any form, it will pay you to talk with Weinman. Write today for complete data. The Weinman Pump Company.

565—See page 59. B-J Bilton Pump: Future production jobs may call for a pump that can do more than one job. The adaptability of the B-J Bilton Pump has special importance to you now. For complete data on the Bilton or a B-J Job-Engineered Analysis of the model for your specific need, write today. Byron Jackson Co.

REFRACTORIES

566—See page 132. Boiler Seam Protector: Free bulletin describes this protector that stops warpage and oxidation of lapped edges; averts leaking, calking, patching. Write today. National Boiler Protector Co.

SOOT BLOWERS & TUBE CLEANERS

567—See page 20. Fast-Acting Wilson Tube Cleaner: See page 20 for the important advantages of this improved Model TP-301 Tube Cleaner. Send today for details, giving your specific requirements. Thomas C. Wilson, Inc.

568—See page 121. Rotojet Tube Cleaners: Rotojet Tube Cleaners, from head to hose, are tailored to meet individual requirements and give you the best combination for a fast, thorough job. Send for new Rotojet Bulletin today. Elliott Company — Roto Division.

STEAM SPECIALTIES

569—See page 129. Steam Traps: Catalog No. 250 furnishes complete data on the Nicholson line of piston and weight-operated steam traps. Write for your free copy. W. H. Nicholson & Co.

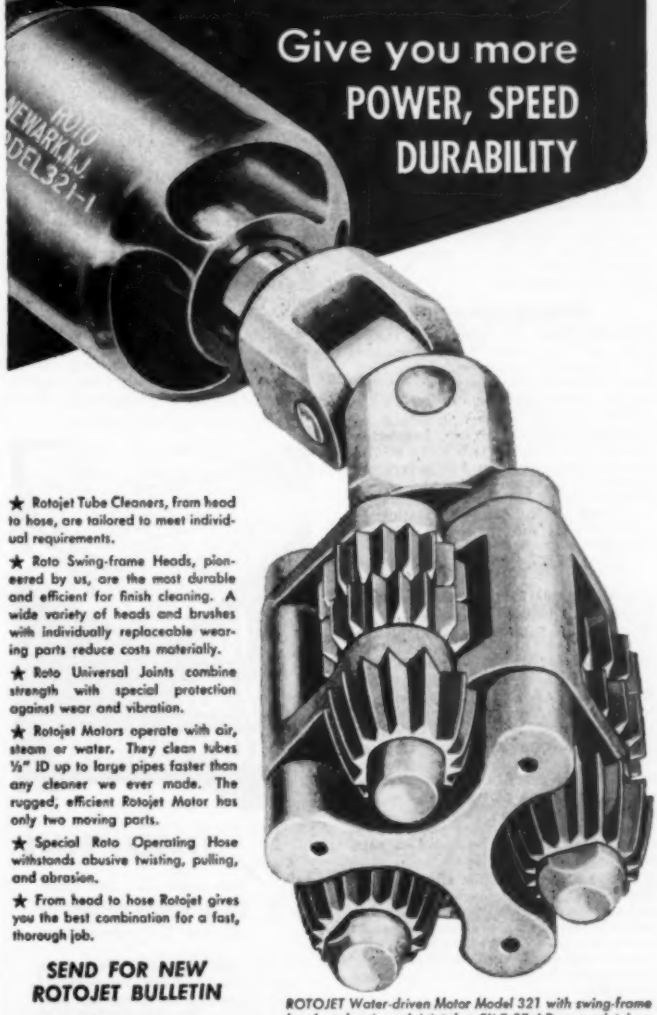
(Continued on page 122)

For your free copies of this new literature and more data on advertised products, list the key numbers of the descriptive paragraphs on one of the handy order cards on p. 117. Mail today—postage-free!

From Head to Hose

ROTOJET TUBE CLEANERS

Give you more POWER, SPEED DURABILITY



★ Rotojet Tube Cleaners, from head to hose, are tailored to meet individual requirements.

★ Roto Swing-frame Heads, pioneered by us, are the most durable and efficient for finish cleaning. A wide variety of heads and brushes with individually replaceable wearing parts reduce costs materially.

★ Roto Universal Joints combine strength with special protection against wear and vibration.

★ Rotojet Motors operate with air, steam or water. They clean tubes ½" ID up to large pipes faster than any cleaner we ever made. The rugged, efficient Rotojet Motor has only two moving parts.

★ Special Roto Operating Hose withstands abusive twisting, pulling, and abrasion.

★ From head to hose Rotojet gives you the best combination for a fast, thorough job.

SEND FOR NEW ROTOJET BULLETIN

ROTOJET Water-driven Motor Model 321 with swing-frame head and universal joint for 2½"-3" I.D. curved tubes.

ELLIOTT COMPANY-ROTO DIVISION

156 Sussex Avenue Newark 1, N. J.

readers' guide to advertised products

(Continued from page 121)

570—See page 151. Impulse Steam Traps: To get equipment hot and into production faster, use Yarway impulse steam traps. Write for full information on how these traps keep equipment continuously at peak operating temperatures. Yarnall-Waring Company.

571—See page 2. Steam Trap Handbook: Tables, charts, diagrams and rules for selecting traps make Armstrong's latest booklet a handy reference volume for every engineer's library. Write today. Armstrong Machine Works.

572—See page 42. Steam Saving Equipment: More than 100 manufacturers of steam operated machinery prefer to equip with Sarco steam traps, temperature controls or strainers before the equipment is shipped. For complete information on Sarco steam saving products, write for Catalog No. 200. Sarco Company, Inc.

THERMAL INSULATION

573—See page 111. Industrial Insulation: Send for new booklet on B-H Block insulation made with black rockwool, flexible and easy to cut, fits tightly over irregular surfaces. Write today. Baldwin-Hill Co.

574—See page 148. Block Insulation: Single layer construction gives insulating efficiency equal to double-layer insulation at all temperatures up to 1800°. Easily handled and cut. Unaffected by water and steam. Ask for Bulletin 1-86. Get complete information today. Refractory & Insulation Corp.

TOOLS

575—See page 131. Combination Blower-Suction Cleaner: It's a snap to rid all of your equipment of damaging dirt, dust, and grit with this portable cleaning tool. Write for more data. Clements Mfg. Co.

576—See page 6. Proto Tools: Send 10c today for the new 68-page catalog of PROTO Tools. Plomb Tool Company.

577—See page 38. Measuring Devices: You can obtain complete information in brochures describing force measuring devices, push pull gauges, traction dynamometers and laboratory scales by checking the brochure you need on the special coupon to be found on page 38. John Chatillon & Sons.

578—See page 137. Tube Cleaning and Expanding: Write for sound advice and top service on your tube cleaning and tube expanding problems. Airetool products help you cut downtime, give lower maintenance cost, more thorough scale removal. Airetool Manufacturing Company.

579—See page 138. Valve and Bibb Reseater: Don't junk expensive globe and angle valves, bibbs, fixtures — reseat them with the Skinner Valve and Bibb Reseater. Easy to use. Pays for itself on first 2 or 3 jobs. Write for more information or order from M. B. Skinner Co.

TURBINES

580—See page 150. Terry Turbines: Read the case history of turbine economy at Narragansett Brewery on page 119. Ask for complete data to prove how a Terry installation may be equally profitable for you. The Terry Steam Turbine Co.

VALVES

581—See page 45. New Valve Design: Chapman Valve List 960 has been improved to give more than 50% increase in strength of stem and wedge gate connection. Valve stems and gates with new connection are interchangeable with all List 960 valves now in service. Write for complete information. The Chapman Valve Mfg. Co.

582—See page 61. Drop Forged Steel Gate Valves: Series 12100 for 150-800 pounds service. ¼" to 2", has round bolted bonnet, bolted gland. Henry Vogt Machine Co.

583—See pages 28, 29. Blow-Off Valves: Unit Tandem Blow-Off Valves constructed with special strength and toughness to withstand severest blowdown conditions. Write for Bulletin B-433. Bulletin B-424 describes lower pressure blow-off valves. Yarnall-Waring Company.

584—See page 10. Piping Layouts: A new book of Jenkins Practical Piping Layouts—Nos. 26 to 50—is in preparation. Write now to reserve your copy. Jenkins Bros.

585—See page 125. Everlasting Valves: Duplex unit gives doubly-safe boiler blow-off action. Everlasting Valve team assures practically zero maintenance as well as double safety. Write today for full information. Everlasting Valves.

586—See page 52. Crane Valves: Dependable quality Crane valves insure low maintenance costs. Ask your Crane representative for a demonstration or write for full details. Crane Co.

587 — See page 133. Water Service Valves: For longer service, less maintenance and greater all-around dependability, specify and install Golden-Anderson cushioned valves. Complete data on request. Golden Anderson Valve Specialty Company.

588—See page 149. Butterfly Valves: Rockwell designs many valves for special applications. Write for catalog describing complete line of standard valves to 72" pipe size — manual or automatic controls. Also, ask to receive "Rockwell Valve News" monthly. W. S. Rockwell Company.

WATER TREATMENT

589—See page 56. Water Conditioning System: Write for full facts concerning this system that gives you all the heating, chemical feeding and clarification facilities for optimum water conditioning results. Ask for Bulletin W-212-B5. Worthington Pump and Machinery Corp.

590—See page 114. Versene Test Kit: Lets you test the hardness of water in your plant in less than two minutes. Includes enough chemical to make more than 50 separate tests. Refills available. Full directions in each kit. Write today. Bersworth Chemical Company.

591—See page 13. Water Conditioning: Write for sound recommendations of Betz' engineers to help you select the water conditioning service best suited for your plant. W. H. & L. D. Betz.

592—See page 134. Water Refining Equipment: Do you want the right answer to your water softening or demineralizing problem? Let Refinite send you specially prepared pictorial literature that shows how Refinite helps get the "right answer". Refinite Corporation.

593—See page 132. Water Treatment: Write for detailed information about solving your water treatment problems. This complete service includes each step from original survey of problem to installation of water purification equipment. General Filter Co.

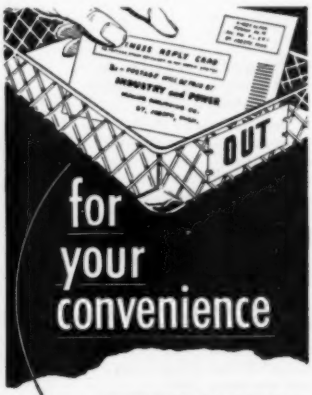
594—See page 131. Water Treating Equipment: Get your copy of fact-filled bulletins giving complete data on manual or automatic equipment in all sizes, types and capacities. Hungerford & Terry, Inc.

595—See page 126. Belco Deaerators: Read page 126 why hot or cold type Belco Deaerators produce such outstanding results. Then, for more information, write for your free copy of illustrated Bulletin 103. Belco Industrial Equipment Div.

WELDING & CUTTING EQUIPMENT

596—See page 50. Welding Equipment: Write today for details of new, money-saving oxygen and acetylene supply plan plus complete line of quality welding and cutting apparatus. Linde Air Products, Division of Union Carbide and Carbon Corp.

597—See page 34. Welding Fittings Catalog: Send for this catalog containing full data on the complete line of Grinnell carbon steel butt welding fittings and forged steel flanges. Grinnell Company, Inc.



READERS' GUIDE

See page 117 for classified list of literature offered by advertisers.

You'll find it so convenient to use one of the postcards on page 117 for requesting literature or more information about advertised products. Just circle the numbers corresponding to the material you want and drop the card in your OUT basket. Your inquiry will be processed quickly and accurately.

Engineering Foundation Reports Research Progress

Engineering Foundation, joint research organization of the four major engineering societies—ASCE, AIM & ME, ASME and AIEE—summarized the progress on the fourteen projects carried out under its sponsorship during the year ending September 30, 1950. Three of these projects are in the field of mechanical engineering, five in civil engineering, four in mining and metallurgical engineering and two are cooperative projects that cut across the whole engineering field. For the support of these projects the Foundation made grants totalling $25,500 and others contributed $967,045.

In the field of mechanical engineering, considerable progress has been made in increasing the accuracy of methods for measuring flowing fluids, in determining the forces needed in the rolling of metals, and in increasing the efficiency of large coal-fired boilers in power-generating plants by eliminating "lazy" surface, thus pointing the way to a more complete combustion of the fuel.

Much important work was done during the year in the field of mining and metallurgy. Noteworthy is the work at MIT on the self-diffusion of iron in which radioactive iron, supplied by the AEC, was used as a tracer. This work has shed new light on the structural changes that occur when steel is hardened by quenching. These changes are shown to take place with split-second rapidity at a temperature only four degrees above absolute zero. This refutes the previously advanced theory that such changes take place by atom-by-atom growth, in which case the changes would need centuries for completion at absolute zero.

Three of the five current projects in the field of civil engineering are well-established and well-financed councils that support research at six universities. Each of these reported excellent progress during the year. Recent work by the Column Research Council has provided much new and valuable information on the buckling of columns, beams and channels—information that should eventually improve the design of compression members in structures.

Work reported by the Council on reinforced concrete was noteworthy and included bending and axial-loading tests, shear and diagonal tests and tests on large stepped columns. These tests and others under way should aid the Council in attaining its major objective. Namely, the development of a workable theory to replace the empirical methods used for many years.

EVER HEAR ABOUT OUR BACKBONE?

You are looking at a series of "troughing" idlers . . . the backbone of a Hewitt-Robins Belt Conveyor. Their concave design enables these idlers to cradle the belt they support . . . increasing its carrying capacity, reducing spillage, lengthening belt life.

The trough-shaped idler was invented in 1891 by Thomas Robins, Sr., founder of this company.

This is but one of a notable list of "firsts" to come from Hewitt-Robins. In belting . . . in machinery . . . in hose . . . in ingenious techniques for handling solid and fluid bulk materials . . . Hewitt-Robins always has pioneered.

Today, Hewitt-Robins is unique in another respect. It is the only organization in the world having, within one corporate structure, the complete belt conveyor "package": engineering, specialized machinery *and belting*. Only Hewitt-Robins can assume undivided responsibility for all the elements of a belt conveyor system; *only Hewitt-Robins makes them all.*

Hewitt-Robins can serve you through three industrial divisions—individually or collectively, according to your needs.

Whenever the handling of bulk materials is *your* problem, we invite you to make it ours.

HEWITT HR ROBINS

Executive Offices: 370 Lexington Avenue, New York 17, N. Y.

HEWITT RUBBER DIVISION: Belting, hose and other industrial rubber products
ROBINS CONVEYORS DIVISION: Conveying, screening, sizing, processing and dewatering machinery
ROBINS ENGINEERS DIVISION: Designing and engineering of materials handling systems

Hewitt-Robins is participating in the management and financing of Kentucky Synthetic Rubber Corporation

NEWS . . . of men and companies

Principals in the new advertising firm, with a background based on two pioneer companies, are, from left to right, E. A. Gebhardt, chairman, Wm. A. Marsteller, president, and R.S. Reed, Jr., executive v-p and Pittsburgh office head

Marsteller, Gebhardt & Reed, Inc.—On May 1, this company will begin operations as an advertising agency, combining the 33-yr old agency of Gebhardt & Brockson, Inc., of Chicago, and the Pittsburgh office of The McCarty Co. E. A. Gebhardt, chairman of the board, was formerly president of the Chicago firm. Wm. A. Marsteller, president, is founder of The Marsteller Co. and has been v-p in both The Rockwell Mfg. Co. and Edwards Valves, Inc., and president of NIAA and CIAA. R. S. Reed, Jr., executive v-p and manager of the Pittsburgh office, has been v-p and in charge of the Pittsburgh office of The McCarty Co., whose other operations will not be affected. Offices will be at 600 S. Michigan Ave., Chicago, and 600 Grant St., Pittsburgh, Pa.

AWARDS

Babcock & Wilcox Tube Co.—Isaac Harter, chairman of the board, received the Newcomen Medal "for achievement in the field of steam" at a joint meeting of the Newcomen society and The Franklin Institute.

Columbia University — Milton C. Whittaker has been awarded the university's Chandler Medal for his outstanding achievements in the chemical industry.

Foster Wheeler Corp. — Company employees received the Liberty Mutual Insurance Co. flag for three years without a lost time accident.

Yarnall-Waring Co.—D. Robert Waring, President, was awarded honorary membership in the Engineer's Club of Philadelphia.

EXPANSIONS

Cummins Engine Co., Inc.—Plans include a 9,600 sq ft extension and new machinery for increased output of fuel pumps. $400,000 is involved.

P. E. Madden & Co.—Bathrick & Palmer Machinery Co., Elkart, Ind., and all equipment has been purchased and will be known as the Mechanical Div. The plant makes about 60 items of major mechanical tools.

National Supply Co.—Consolidation of sales and service facilities with those of the Atlas Imperial Diesel Engine Co., acquired last July, are complete.

United States Steel Corp.—A new steel plant of 1,800,000 tons capacity, largest on record, will be started near Morrisville, Pa., March 1.

United States Rubber Co.—The Kankakee ordinance works will be reactivated to manufacture explosives.

Worthington Pump and Machinery Corp.—Plant and equipment of the National Transit Pump and Machine Corp. have been acquired and will be used for the miscellaneous overflow from other company factories.

E. I. duPont de Nemours & Co.—Buildings have been bought near Columbia, Tenn., for probable conversion into a cellulose sponge plant.

Aluminum Company of America—An alumina plant will be built near Bauxite, Ark. It will increase the company's alumina production 50 per cent.

American Machine & Foundry Co.—New production facilities are contemplated to meet heavy equipment demands for the armed forces.

Allis-Chalmers Mfg. Co.—All physical assets of Canadian Allis-Chalmers, Ltd., have been purchased by a new wholly owned subsidiary. The plant, including 17 acres of land and five buildings, was operated under license.

Bendix Aviation Corp.—The Ford plant at Hamilton, O., was purchased for production of aircraft parts and accessories. Bendix Radio Div. also announces restoration of its subcontracting plan, which amounts to over $20,000,000 for military contracts.

Cleveland Pneumatic Tool Co.—To boost output of landing gear and other products, a $2,500,000 expansion should be completed about July 15.

Dow Chemical Co.—Deed to the Standard Steel Spring plant at Madison, Ill., was acquired from General Services Administration. Installations will include the first modern continuous rolling mill for magnesium.

Dravo Corp. — Authorization has been received for seven 100-ton capacity and six 60-ton floating cranes for Department of the Navy.

B. F. Goodrich Chemical Co.—With several large Japanese industrial firms, arrangements for the new Japanese Geon Co., Ltd., to construct facilities in Japan for the manufacture of polyvinyl chloride have been completed.

Hagan Corp.—A new office has been established at 1463 Monadnock Bldg., 53 W. Jackson Blvd., Chicago.

H. K. Ferguson Co.—Contract received from Baroid Sales Div. of National Lead Co. for new office and research center with 40,000 sq ft of floor space, fully air conditioned.

A $650,000 contract calls for installation of process equipment at Picatinny Arsenal at Dover, N. J.

Independent Pneumatic Tool Co.—Armstrong-Whitworth and Co., Pneumatic Tools, Ltd., England has been purchased. The company employs 750.

Lone Star Steel Co.—General contract for the $73,000,000 steel mill to be built at the East Texas works was awarded to Brown & Root, Inc.

MacIsaac, Menke and Roach, Inc.—Building contract was received for $60,000 office and warehouse for Garlinghouse Bros. in Los Angeles.

Minnesota Mining & Mfg. Co.—Purchase of a 114 acre tract in southwest Chicago is part of long range development including $3,000,000 plant recently started for Mid-States Gummed Paper Co., a subsidiary.

Rockwell Mfg. Co.—A 150,000-sq ft manufacturing plant for Tupelo, Miss.

Swartwout Co.—New sales office at 18511 Euclid Ave., Cleveland, is announced by the Power Plant Equipment division of the company.

Texas Gas Transmission Corp.—Included in a $42,300,000 pipe line construction program are a 4,500-hp station and addition of 5,460 hp at four existing stations in Tennessee and Kentucky.

APPOINTMENTS

Allis-Chalmers Mfg. Co.—William Alva Roberts to president, succeeding Walter Geist, whose death is reported in the obituaries. W. C. Johnson to executive V-P. Edmund Fitzgerald, president of Northwestern Mutual Life Insurance Co., to board of directors.

Davey Compressor Co.—W. W. Warner to v-p of engineering, succeeded by Ernest S. Theiss as chief engineer.

Pyrene Mfg. Co.—Wallace B. Phillips to president. He has been with the company since 1913. Along with nu-

merous international activities, he is president of the American Chamber of Commerce in London and the American Society in London.

Revere Copper and Brass Inc.—Paul B. Andrews granted leave to serve as chief of Brass Mill Section of NPA.

Bigelow-Liptak Corp.—Victor P. Johnson to sales staff. He was formerly with the Kellog Co.

ASME—Alfred F. Bochenek as news editor of "Mechanical Engineering."

Atlas Chain and Mfg. Co.—Carl J. Meister to v-p and director of sales.

Borg-Warner Corp.—Harold G. Ingersoll to v-p; he remains president of Ingersoll Steel Div. L. G. Porter to treasurer. Arthur Peacock to assistant secretary-treasurer and controller of Borg-Warner International Corp.

Conoflow Corp.—John C. Kock to v-p in charge of sales.

Cooper-Bessemer Corp.—Walter H. Kraemer to the field sales and service office in San Francisco.

A. K. Kolar

S. T. Penick

Link-Belt Co.—Andrew K. Kolar to assistant sales manager for the Chicago Pershing Road plant products. He will be replaced as district manager at Moline, Ill., by Stuart T. Penick. Orvin K. Gaskins as manager of aircraft sales, Indianapolis Ewart plant.

Manning, Maxwell & Moore, Inc.—Robert E. Mason as director of mobilization planning for Consolidated-Ashcroft-Hancock division. Leslie T. Willard as works manager of the combined Bridgeport and Stratford, Conn., plants.

Dampney Company of America—Howard N. Verrault to branch manager of the Chicago office, 53 W. Jackson Blvd.

DeWalt, Inc.—O. Stanley Swandahl as district manager for Lake County, Ill. and parts of Wisconsin.

Dravo Corp.—Walter L. Davidson to sales manager for the Heating Dept. Henry G. Fieger as shop manager for the fabricated piping plant.

Diamond Alkali Co.—A. L. Geisenger to a vice-presidency.

General Electric Co.—Robert L. Gibson to general manager of chemical dept. Everett S. Lee as editor of "General Electric Review" replacing Edward C. Sanders, retired.

Henry J. Chanon to manager of the Lighting Institute at Nela Park, now a division. Ralph E. Donnelly to manager

These EVERLASTING advantages give better service from

Fig. 4001/6561. Duplex unit consisting of Straightway Lever-operated Sealing Valve and Angle Blowing Valve.

BOILER BLOW-OFF VALVES

When you install an EVERLASTING Duplex Blow-Off Unit, you'll find that its many superiorities speak for themselves.

The sealing valve at the left is the EVERLASTING design that has been famous for more than 40 years . . . the valve with the drop-tight seal that actually improves with use because of its self-lapping action each time the valve is opened or closed . . . the valve that can't stick or jam because of its non-wedge design . . . the valve that opens in less than a quarter turn to provide unimpeded straight-through blow.

The blowing valve at the right is the equally famous EVERLASTING Angle or "Y" Valve, specially designed and equipped to withstand repeated blow-off shocks, erosion and corrosion, and without pockets that might trap and hold solids.

Each of these valves . . . and all the other EVERLASTING Boiler Blow-Off valve types, fully meet ASME code requirements . . . assurance that they are properly designed and amply strong for the service.

Write for descriptive bulletin

EVERLASTING VALVE CO.
49 Fisk Street, Jersey City 5, N. J.

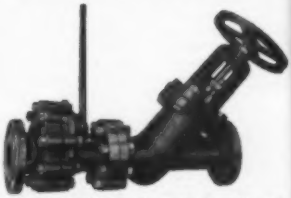


Fig. 4001/6571. Duplex unit consisting of Straightway Lever-operated Sealing Valve and Y Blowing Valve.

Fig. 6571/6561. Duplex unit consisting of Y Sealing Valve and Angle Blowing Valve.

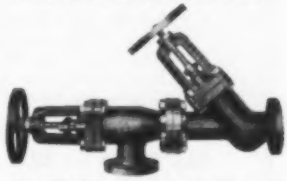


Fig. 6561/6571. Duplex unit consisting of Angle Sealing Valve and Y Blowing Valve.

Everlasting Valves

TRADE MARK "EVERLASTING" REG. U.S. PAT. OFF.

EV-340

FOR EVERLASTING PROTECTION

of Fitchburg turbine sales division.

Hardage L. Andrews, Henry V. Erben and Roy W. Johnson to executive vice-presidencies.

Trane Co.—R. E. Lucy and H. C. Rooks to vice-presidencies. E. A. Cline to sales manager, succeeded by R. E. Haskins as manager of convector-radiator sales.

Worthington Pump and Machinery Corp.—Robert T. Haslam, formerly with Standard Oil Company (N. J.), to board of directors. W. A. Finn as general European manager in Paris.

Hutchinson Foundry and Steel Co. as distributors in southern Kansas.

Robert R. Anderson to v-p. He was president of Worthington-Gamon Meter Co., which is now a division with William C. Flanders as assistant general manager.

Westinghouse Electric Corp.—W. G. Miller to manager of manufacturing, Motor and Control Div., Buffalo. Bruce D. Henderson as general purchasing agent and Wesley H. Lees as general traffic manager. W. P. L'Hommedieu to assistant Pacific Coast manager.

Elected new vice-presidents are L. W. McLeod, southwestern district manager, St. Louis; E. W. Loomis, middle Atlantic district manager, Philadelphia; L. E. Lynde, head of the company's government office, Washington; and Tomlinson Fort, manager of headquarters apparatus sales.

C. V. Rosenberry to central station manager. R. W. Doering, supervisor of plant engineering, Bloomfield.

Atomic Energy Commission—S. R. Sapirie to manager of Oak Ridge operations.

National Aluminate Corp.—Joseph A. Holmes to vice-president. He has been assistant v-p for a number of years and is a recognized authority on water treatment for up to 3000 psi.

J. A. Holmes S. W. Hickey

Fairbanks, Morse & Co.—S. W. Hickey to assistant manager of the railroad products department. He was sales manager of the Simmons-Boardman Publishing Corp. and has had considerable previous experience in actual railroad service. Orren S. Leslie, formerly with Electromotive Div. of General Motors, to manager, Beloit Works.

Rockwell Mfg. Co.—L. A. Dixson, v-p, to director. He was president of Pittsburgh-DuBois Co., now a division.

Lee Rubber & Tire Corp.—C. R. Conklin, eastern district manager for Republic Rubber Div., to manage the Philadelphia office, replacing Warren Ingersoll, now assistant to president of the Lee corporation. R. L. Beveridge to field engineer for Republic at Philadelphia office.

Round Associate Chain Co.—R. R. Tettelbach as advertising manager for associated companies. W. J. Keenan to general manager of Woodhouse Chain Works, and J. L. Hiers as his assistant.

Sylvania Electric Products Inc.—J. T. Burdick as director of midwest sales with headquarters in Chicago.

Ross Operating Valve Co.—D. A. Ditirro to sales and service manager. He was with the Parker Appliance Co. as chief research engineer.

Dow Chemical Co.—Earl Collins, to assistant division superintendent of Styron div.; R. E. Peterson to director of color laboratory and J. L. Williams to director of control and inspection laboratory.

Okonite Co.—E. D. Soumans to v-p in charge of manufacturing and research, replacing D. R. Stevens, who is retiring after 30 yr of managing factory operations.

National Electric Products Corp.—J. S. Cowan to manager of government business for the company in Washington office.

Nordberg Mfg. Co.—Thomas B. Meekin as sales engineer, heavy machinery div., San Francisco office.

?Water Problem?

Let us help you solve it—
HOW? WITH—

Inversand Zeolite Water Softeners
Sand and Anthracite Water Filters
Demineralizing Units
Condensate De-Oiling Filters
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Lime-Soda Water Softeners
Ferrosand Iron and Manganese Filters
Acticar Carbon Filters
Silica Removal Equipment
Sludge Blanket Coagulators
Gravity Air-Water-Wash Filters
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ALL SIZES — ALL CAPACITIES

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Clayton, New Jersey
Over 50 years experience—Over 5,000 installations

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LIQUIDOMETER
Tank Gauge
WRITE FOR COMPLETE DETAILS

THE LIQUIDOMETER CORP.
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United States Air Conditioning Corp.—F. G. Reidel to chief engineer in charge of design, development and research. He was chief engineer of Worthington Pump & Machinery Corp.

Wagner Electric Corp.—H. B. Nechemias to industrial sales manager succeeding J. S. Smith who was appointed director of purchasing.

R. E. Anderson C. S. Beattie

H. K. Porter Co., Inc.—C. S. Beattie to executive v-p and general manager and R. E. Anderson to senior v-p of Delta-Star Electric Co., recently acquired and made a division.

Pangborn Corp.—V. F. Stine to director and v-p in charge of sales and engineering. L. L. Stouffer to director and secretary-treasurer. P. J. Potter, retiring from more active duties, continues as v-p and director.

B. F. Goodrich Co.—Carl J. Tsaloff to manager of Cadillac, Mich., plant, succeeding F. G. Tanner, retired because of health.

Hagan Corp.—R. R. Donaldson, v-p of engineering, and Dr. E. P. Partridge, director of Hall Laboratories, elected to board of directors.

Hercules Powder Co.—H. E. Hartzell to supervise production activities of company's British operations.

Industrial Unit Heater Assoc.—Re-elected are J. C. Patterson, director of industrial heating sales, Carrier Corp., to president; H. S. Wheller, president of L. J. Wing Mfg. Co., to vice-president; and L. O. Monroe to secretary-treasurer.

Johns-Manville Corp.—C. F. Rassweiler to newly created vice-chairman's office; L. M. Cassidy to president. L. H. Brown, chairman, remains chief executive officer. J. A. O'Brien, H. R. Berlin and A. S. Elsenbast, general managers and former vice-presidents of J-M Sales Corp., are now vice-presidents of the parent company.

NEW REPRESENTATIVES

Conoflow Corp.—J. R. Simpson and Co., 600 S. Michigan Ave., Chicago, to operate in Illinois, Indiana and Wisconsin.

Continental Foundry & Machine Co.—Warriner Equipment Co., 504 Delta Bldg., New Orleans, will represent both Northern Equipment Div. and Vulcan Soot Blower Div. of the company.

Hanna Engineering Works—Industrial Air & Hydraulic Equipment Co., 13306 Kercheval Ave., Detroit, to be exclusive representatives in all of Michigan east of Lake Michigan.

James-Pond-Clark—Norman Engineering Co., 2035 W. Charleston, Chicago; Nielsen Hydraulic Equipment, Inc., 298 Lafayette St., New York; and Scott Equipment and Engineering Co., 1316 Lorain Ave., Dayton, O., will stock the company's check valves.

Kieley & Mueller—Joseph H. Bertram & Co., with new offices at 209 Washington St., Boston, will cover New England except Connecticut.

Joseph T. Ryerson & Son, Inc.—Exclusive distributor for Rockrite tubing for the Tube Reducing Corp.

Rust-Oleum Corp.—Roy J. Bell, with headquarters in Tulsa, will cover Oklahoma and Kansas.

Wheelco Instruments Co.—Ansell & Goda, with new offices at 3432 Connecticut Ave. N. W., Washington, will cover the District of Columbia, Virginia and part of Maryland.

Eriez Mfg. Co.—C. D. Sutton, Inc. as representative in Los Angeles area, with complete research and laboratory facilities available.

Nordberg Mfg. Co.—Dakota Electric Supply Co. as distributor for 4FS diesels in North and South Dakota, northwestern Minnesota and northeastern Montana territories.

Johnson Corp.—Guy L. Warden & Sons as representatives for all of California and parts of Oregon.

OBITUARIES

Allis-Chalmers Mfg. Co.—Walter Geist, president, died suddenly January 28. He was a director of many firms and organizations, and had received three honorary doctor's degrees and Norway's highest award, the Knights Cross.

Roots-Connersville Blower Corp.—John Avery, president, died January 13. He had received the Kellex Key for outstanding service in atomic development work during World War II.

Hamilton-Thomas Corp.—Richard H. Thomas, 87, founder and chairman of the board, died December 30. He had obtained many basic patents in air conditioning, and had served as president of the corporation until 1947.

International Nickel Co. of Canada, Ltd.—Robert C. Stanley, chairman of the board of directors died February 12. He joined the company when it was founded in 1902. He discovered monel and produced it directly from the ore. For his many contributions to the field, he has received numerous high awards and honors.

United States Steel Corp.—William C. Loyd died February 12. He headed construction of the company's sheet and tin mill at Gary and was general superintendent there until his retirement in 1931.

Flow Stubborn Materials
Thru Bins, Hoppers
And Chutes

APPLY
SYNTRON
"Pulsating Magnet"
ELECTRIC VIBRATORS

TO HOPPERS

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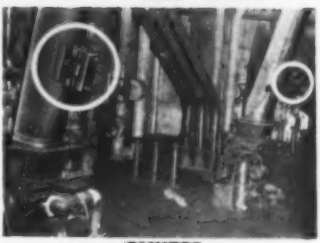

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If you have such a problem, send us the details.

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MEETINGS and EXHIBITIONS

Highlights of coming meetings that will aid executives and engineers in planning itineraries. For additional information, please write sponsors of meetings

MARCH

National Association of Corrosion Engineers seventh annual conference and exhibition will be held at the Statler Hotel, March 13 to 16. Symposiums to be held include on March 13 corrosion principles, water industry and pipe line industry problems; on March 14, boiler feedwater, chemical industry, transportation industry and protective coatings; on March 15, oil and gas industry, cathodic protection, electrical and communications industry and corrosion inhibitors. March 16 includes round table discussions on general problems and pipeline and underground corrosion problems.

Instrument Society of America holds its Pittsburgh Section conference in that city March 28 and 29. Local sections of other societies aid in the program, "Instrumentation in the Steel Industry".

APRIL

Materials Handling Exposition will feature new developments in outdoor materials handling at the International Amphitheatre, Chicago, April 30-May 4. Clapp and Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

The British Industries Fair will be held April 30 through May 11. Heavy industry will be centered in Birmingham (England) and other trades will be on display in London. British Information Services, 30 Rockefeller Plaza, New York 20, N. Y.

Midwest Power Conference—The fourteenth annual conference will be held April 4, 5, and 6 at the Sherman Hotel in Chicago. The annual three-day meeting is sponsored by the Illinois Institute of Technology and 18 midwestern universities, aided by a ten-man industry committee.

Machine Tool Electrification Forum sponsored by Westinghouse Electric Corp. will be held at the William Penn Hotel, Pittsburgh, on April 10 and 11. Talks will include subjects on defense, conservation of manpower and materials, drives, motors and controls. Open forum discussions are featured.

American Institute of Electrical Engineers announce three district meetings preceding the Summer General Meetings, Toronto, Canada, June 25-29.

Southern District meeting is scheduled for April 11-13 at Miami Beach, Florida.

Syracuse will be the scene of the Northwestern District meeting, May 2 to 4.

The Great Lakes District meeting will be held from May 17 to 19 in Madison, Wisconsin.

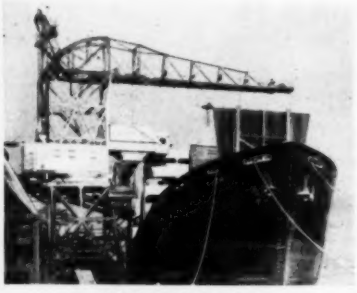
Oil Heat Institute of America will hold its convention April 2-6 at the Palmer House in Chicago. For details, write Mr. Kaufman, secretary, Oil Heat Institute, New York 16, N. Y.

MAY

Third World Petroleum Congress will be held at The Hague-Scheveningen (Holland) from May 28 to June 6, 1951. For more information or copies of papers, write Office of Secretary, USA National Committee, K. G. Mackenzie, 135 East 42nd St., c/o The Texas Co., New York 17, N. Y.

JUNE

International Commission on Illumination will hold an annual session June 25 to July 4, 1951 in Stockholm, Sweden. New offices of the I.C.I. have been opened at 570 Lexington Ave., New York, N. Y., under direction of Secretary General R. J. Whitney.



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BOOM STACKER

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Built for *American Cyanamid Company*

Through the many years of experience of our engineers, we have developed, designed, manufactured and constructed the **first** push button operated bucket unloading revolving tower-crane with pivoted boom, built-in rotating hopper and movable operators cab all mounted on stationary gantry tower.

Also the **world's first** self-contained hydraulically operated (belt conveyor) boom stacker featuring hydraulic ram for raising and lowering boom, hydraulic motors for driving the belt and slewing the boom.

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REVIEWS of RECENT BOOKS . . .

The latest books, read by the Plant Engineering Group, are reviewed here for your convenience. Write directly to the publisher for those in which you are interested

Capacitors

"Capacitors for Industry," by W. C. Bloomquist, industrial engineering division; C. R. Craig and R. M. Partington, capacitor engineering division, General Electric Co.; and R. C. Wilson, Trumbull Electric Manufacturing Co., edited by Mr. Bloomquist. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Illustrated, 246 pages. Price $4.50.

This book should be of special value to the industrial plant engineer and electrician, utility power salesman, consulting engineer, and industrial power application engineer. Since these persons want a practical solution quickly, the application information and data have been presented in tabular and curve form. In most cases the answer can be obtained directly without the solution of the right triangle or use of complex algebra. Numerous examples are included illustrating the use of data and, where necessary, the step-by-step procedure for solution of practical problems. Although power-factor problems of a utility distribution system are quite different from those of an industrial power system, the utility engineer will find many of the data handy.

German Chemicals

"The German Chemical Industry, A Bibliography of the Chemical, Metallurgical and Process Industries," PB 101 458, issued by the Office of Technical Services, Department of Commerce, 396 pages, sells for $10 per copy. Orders should be addressed to the Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C., and should be accompanied by a check or money order payable to the Treasurer of the United States.

This new bibliography, a product of several years' work by L. Wilson Greene of the Army Chemical Corps, has been reproduced by O.T.S. because of its usefulness to the researcher in these fields who is seeking full information on German developments. It contains well over 2,000 document references with descriptive titles or abstracts, and includes a 6,000-entry subject index, author indexes, and cross-indexes with O.T.S., British, and U.S. Military reports. Particularly helpful are sections dealing with the translations and reports available from private publication services, since O.T.S. has not been able to cover these materials fully in its "Bibliography of Technical Reports."

In addition to presenting general references on postwar conditions in Germany with regard to the chemical, metallurgical and process industries, the report gives published references for five major classifications of the German chemical industry, including dyes and pharmaceuticals, 11 classifications relating to metallurgy, and 20 relating to process industries.

Natural Gas Pipeline

"Underground Highway" describes Texas Gas Transmission Corp.'s new $73,500,000 natural gas pipeline project and efforts being made to bring an increasing amount of natural gas to the "big river region", an area extending from Arkansas and Mississippi on the south to Kentucky and Indiana on the north. Film contains a series of sequences portraying, for the first time, specific application of natural gas to mass production and precision operations.

Prints may be obtained without charge, except for mailing costs, by writing to Texas Gas Transmission Corp., Owensboro, Ky.

Soldering

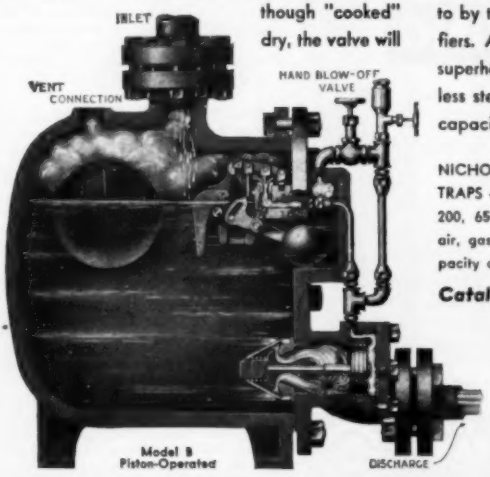
"Soldering Tips," by Weller Electric Corp., Easton, Pa. 10¢ per copy.

A simplified, vest-pocket course in professional soldering, first published in 1948, has now been revised, and will double as a refresher course for experienced solders. Its 20 pages cover the whole soldering operation, time-saving methods, do's and don'ts, difficult points, flux and solder tables.

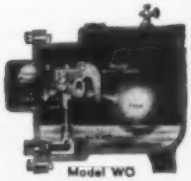
THIS NICHOLSON "POWER SERVICE" TRAP

WON'T LEAK EVEN IF 'COOKED' DRY

Nicholson piston-operated traps do not depend on buoyancy of float to raise valve. Thus, even though "cooked" dry, the valve will not leak live steam. With valve orifice up to 2" diam., they have enormous drainage capacity. This is attested to by the fact that thousands are installed on steam purifiers. Also widely used on headers, separators, heaters and superheated steam lines. Rugged; working parts of stainless steel; pressures, 2 to 650 lbs. The lowest price large capacity trap.



NICHOLSON WEIGHT-OPERATED TRAPS — Three models for press. to 200, 650 and 1500 lbs.; for steam, air, gasoline. Also feature large capacity and proof against leaking.



Catalog 250 or see Sweet's

W. H. NICHOLSON & CO.

135 OREGON ST., WILKES-BARRE, PA.

Representatives, in 53 Principal Cities, to Help You Solve Specification and Maintenance Problems in Traps, Floats, Control Valves.

NEW BULLETINS

(Continued from page 33)

To obtain any of these free booklets circle the corresponding number on one of the convenient post cards on p. 117.

247—Gaskets. Complete line of metal, metal-asbestos and cut gaskets from any material to standard sizes or to specifications is covered in one section of 48-page general catalog. Other half of book is devoted to Teflon, its properties and uses, together with detailed information on various gaskets, packings, adaptors and expansion joints. Teflon sheets, cylinders, rods, tubing and bars are also listed. Fully illustrated with photographs and line drawings. United States Gasket Co.

248—Right Angle Pump Drives. The best means of driving a vertical pump with a horizontal driver is the Gearturbo, says this manufacturer of vertical deep well turbine pumps. Especially where natural gas, gasoline, diesel or steam power is more economical or where standby power is desired. Construction features of the right angle gear head are given in 8-page bulletin along with sectional drawings and dimensions, details of the flexible shafts, hp ratings and suggested methods of application. Peerless Pump Div. Food Machinery & Chemical Corp.

249—Pumps. Although condensed, this 12-page catalog presents a full line of pumps for handling corrosive and non-corrosive liquids, solids-carrying liquids and dry and semi-dry materials. Divided into three main sections the books shows how to select pumps for different applications and then explains their application, operation and advantages. Yeomans Brothers Co.

250—Sewage Ejector System. Pneumatic sewage ejector costs little to operate and maintain. More sanitary, efficient and economical are some of the advantages claimed. Photos, cutaway views, diagrams, charts and tables tell you all about it in 12-page bulletin. The Blackburn-Smith Mfg. Co.

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A SOOT BLOWER PACKING PROBLEM
with the RIGHT combination of
"JOHN CRANE" PACKING
Problem: Leakage caused by packing vulcanizing and hardening where temperatures were over 400° F.
Solution: The *right* combination of "John Crane" packings ...styles 177AM and 177J...offered maximum sealing ability, heat resistance and non-vulcanizing properties at elevated temperatures.
Results: Over six months of service, as compared to one or two weeks service from the rubberized fabric-type packing formerly used.
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PACKINGS AND MECHANICAL SEALS
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Offices in All Principal Cities in United States and Canada

TOOLS AND SPECIALTIES

251—Tools & Attachments. Line of tools and attachments for radial arm cutting machines used in the woodworking, metal and plastics industries is listed in 12-page illustrated catalog. Gives specifications and dimensions along with a brief description of each unit. DeWalt Inc.

252—Carbide Tools & Parts. Here is a 60-page catalog that not only lists tools, blanks, etc., but tells how to select and apply them. The 30-page tool and blank section includes information as to most suitable uses of each type plus an illustrated example or two. Differences in the various grades of carbide are clarified. This along with design and application data make it easy to select the correct grade. Non-tool parts are also listed and illustrated. Carboloy Co., Inc.

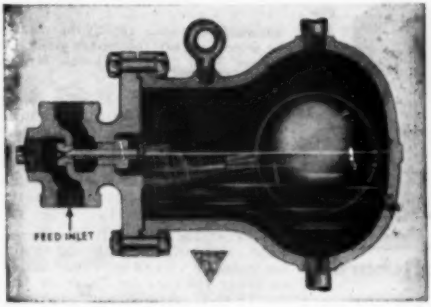
253—Sectional Scaffolding. Convenience, economy and other advantages of sectional tubular steel scaffolding are shown pictorially in 12-page bulletin. Photographs and line drawings give detailed information on erection and dismantling of basic units, available frames and components, and a wide variety of actual applications. The Patent Scaffolding Co.

254—Pipe & Bolt Machines. Pocket-size folder packs a wealth of factual data on three models of portable pipe and bolt machines. Also shown are the power drives as well as pipe cutter and pipe threader designed for use with electric power drives. Beaver Pipe Tools.

255—Portable Electric Tools. Drills, screw-drivers, grinders, sanders and polishers are illustrated and described, and complete specifications on every tool are given in new catalog. Features complete line of 360 and 180-cycle portable electric tools. Buckeye Tools Corp.

256—Metal Shaper. Up-to-date information on 7 in. metal shaper is featured in new bulletin. Complete specifications, catalog listings and illustrations

(Continued on page 132)



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Valve-in-end construction gives you simple, compact design that's built for maximum performance. You can get STETS Type G regulators in either piston or orifice valve units—250-400 w. s. p.—other types to 900#.

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Belco Deaerators

PRODUCE OUTSTANDING RESULTS!

The Belco Atomizing Valve is used in the initial step of all Belco Heaters, Deaerators and Hot Process Softeners to insure superior results. The Valve divides the incoming water into such finely atomized droplets that heating is practically instantaneous when sprayed into an atmosphere of steam. Because of the rapid primary heating, the subsequent steps of separation of the gases and/or chemical action are greatly facilitated.

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ENGINEERING SERVICE

The long experience of Belco's well informed staff of engineers is available to you at all times.

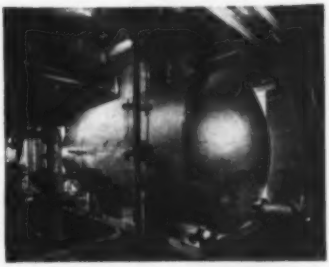

Photo at right Belco High Pressure Steam Deaerator. Capacity 300,000 lbs. per hour.

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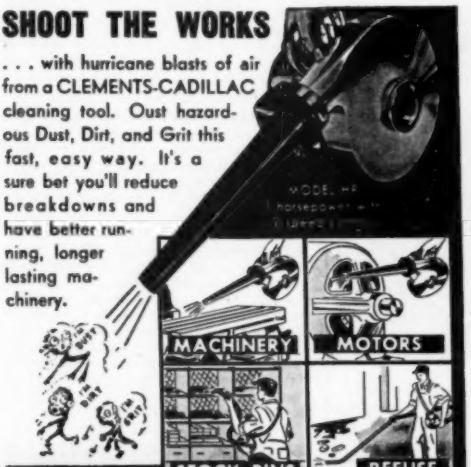

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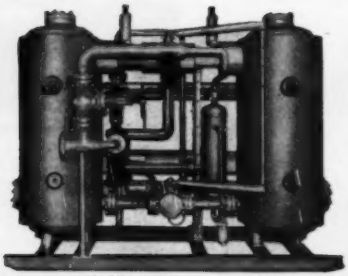

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IS AN ASSET TO THE ENTIRE COMMUNITY

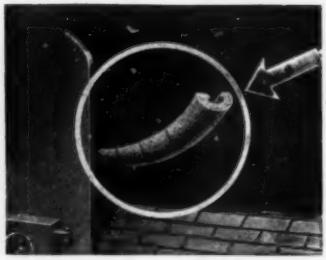
Manufacturing, processing, heating and cooling always improves with pure, bright water. If your water supply needs treatment to remove hardness, iron, taste or odor it will certainly pay to have your problem surveyed by GENERAL FILTER CO. engineers.

G.F.C. is part of the LAYNE organization with engineering and construction facilities in every area. A complete service is offered, from the first survey to the installation of economical and efficient water purification equipment.

Write For Detailed Information Today

A Layne Affiliate
GENERAL FILTER CO.
923 2nd St. • Ames, Iowa

Is Your HRT Boiler Worth Saving?



Whether old or new, every riveted HRT boiler needs seam protection. Otherwise, the lapped edge of the plate is sure to bulge and burn.

National Seam Protectors have averted costly maintenance and repairs on hundreds of HRT boilers since 1916. In fact, many a boiler would have been scrapped long ago except for National seam protection.

If you want to avoid leakage, calking, patching, and possible explosion, get complete information on National Seam Protectors. Write now while the subject is on your mind.

NATIONAL BOILER PROTECTOR CO.
928-9 Rybold Bldg. • Dayton 2, Ohio

(Continued from page 130)

showing the wide variety of what can be done with the shaper are given. Delta Power Tool Div., Rockwell Mfg. Co.

257—Slide-Set Vise. Handle spinning is eliminated—the jaws slide to any position and as the work is engaged the vise operates conventionally. Full information on this new development in vises is contained in 4-page well-illustrated bulletin. Dodge Mfg. Co.

258—Portable Winch-Hoist. Versatile hoist, weighing only 8½ lb, that can be instantly rigged to either lift, pull or lower 1½ tons for 7½ ft, or ¾ ton for 15 ft is pictured and described in 4-page bulletin. Features include aluminum, alloy construction, oiled-for-life bearings, interlock pawl arrangement for safety. Can be made tamperproof by removing handle. Built-in pulley block and three swivel hooks permit working around corners or in close quarters. The Lug-All Co.

VALVES, PIPING AND FITTINGS

259—Steam Traps. Revised edition of "Solving Steam Trap Problems" contains 36-pages of helpful, practical information for engineers and maintenance men concerned with specifying, installing and servicing steam traps. Complete specifications and capacities on steam traps, float traps, air release valves and pipe line strainers are given. Describes how to calculate condensation loads and select traps for all classes of equipment. Gives pointers on how to install traps with the fewest fittings and how to service traps quickly and efficiently. Well illustrated with installation photographs and sketches showing typical arrangements, and construction. V. D. Anderson Co.

260—Steam Capacity Chart. Two-color steam capacity chart enables you to determine steam capacity required from safety valves to give 100% protection in case of pressure reducing valve failure. Marine & Industrial Products Co.

261—Corrugated Metal Pipe. When planning sewers, culverts, conduits or similar systems Armco's 20-page bulletin may help you in selecting the pipe best suited to your needs. Describes prefabricated corrugated metal structures in diameters up to 96 in. Includes convenient, authoritative engineering data. Photographs and sketches illustrate applications. Armco Drainage & Metal Products Inc.

262—Valves, Fittings, Flanges. If you're dealing with liquids and gases of any sort, under high or low pressure you will be interested in this 400-page catalog. Drop forged steel valves, fittings and flanges for every modern piping need are pictured and described. Special section on refrigeration is included. Henry Vogt Machine Co.

263—Reducing Valve. Used to protect water lines where high initial pressure would cause serious damage, this "Cushioned" water pressure reducing valve is fully covered in 6-page bulle-

tin. Installation, operation, adjustment, servicing and specifications are fully described. Tables show general dimensions and weights. Golden-Anderson Valve Specialty Co.

264—Flexible Ball Joints. Most comprehensive bulletin on this subject ever published—that's what Barco says of its 16-page booklet aimed at design as well as plant engineers. Flexible ball, swing, swivel, revolving and other types of movable joints for use in piping for power, process, heating, chemical or hydraulic service are thoroughly discussed. Contains complete specifications, dimensions and application data. Barco Mfg. Co.

For more information use one of the convenient reply cards on page 117. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you.

265—Drainage Manual. To assist engineers and superintendents in the proper methods of installing drainage structures, culverts, sewers or conduits this company offers an illustrated 46-page installation manual. Discusses the handling of metal drainage products, location, proper excavation and preparation of base in various types of soils and rock. Armco Drainage & Metal Products, Inc.

266—Light-Weight Pipe. Lockseam Spiralweld pipe give plus performance on jobs in the power plant, materials handling, mining, oil, and sewage disposal fields says 4-page illustrated bulletin. Include typical applications along with data on fittings, flanges, connections and pipe specifications from 4 to 30 in. ID. Naylor Pipe Co.

HEATING, VENTILATING AND AIR CONDITIONING

267—Dust Control. Plant engineers responsible for dust control are the target of 50-page book that presents detailed selection, operation, and maintenance data. Has three major sections: Exhaust Hoods and Piping Systems, Dust Collecting Equipment, and Exhausters and Drives. Lists six basic methods of accomplishing dust control; gives reasons why failures occur; analyzes with text and line drawings the three basic elements of dust control exhaust systems. Detailed information and engineering data make this book a worthwhile addition to your reference library. Pangborn Corp.

268—Air Drier. Moisture, dirt, oil and fine scale in compressed air lines can be hurled out by centrifugal force and gravity pull. Condensed catalog shows how it's done with the Aridifier. Explains the principles and describes features. Engineering information is presented in tabular form. Of particular interest is table of cfm requirements on various pneumatic applications. Logan Engineering Co.

269—Dust Collectors. Illustrations and specifications of complete line of dust collectors are contained in 38-page catalog. Dry grinding dust problems

For dependable

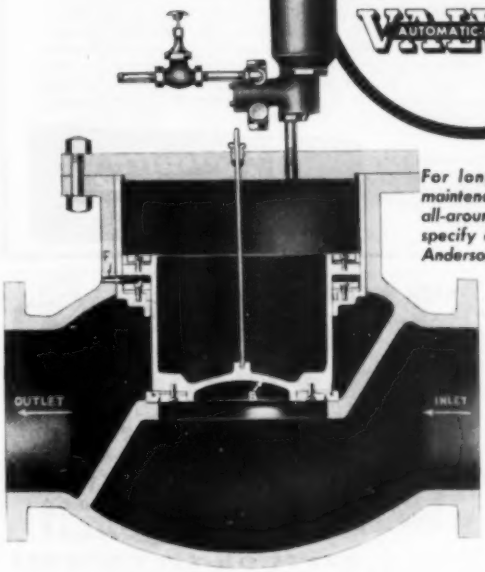
Trouble-Free

MILL QUENCHING, COOLING and DESCALING OPERATIONS

GOLDEN-ANDERSON

Cushioned VALVES

AUTOMATIC-SOLENOID



For longer service, less maintenance and greater all-around dependability—specify and install Golden-Anderson cushioned valves.

The plate mills, structural mills, strip mills, rail mills and sheet mills of America have proven the efficiency and dependability of Golden-Anderson cushioned electrically operated Water Service Valves. The air and water cushioning feature prevents hammer or shock. These automatic valves provide full pipe line area when open, are drop tight when closed, and permit adjustable closing speed.

GOLDEN ANDERSON Valve Specialty Company

2095 KEENAN BUILDING—PITTSBURGH 22, PA.

What Your REFINITE NEIGHBORS are doing in the...
INDUSTRIAL FIELD! At Boys Town, Nebraska, REFINITE installed two softening tanks, two brine measuring tanks, and one salt storage tank in the recently completed new boiler plant. These Softener tanks are 6 feet in diameter and 6 feet high, with a maximum flow of 150 gpm and back wash rate of 170 gpm, supplying boiler house, laundry etc. A hardimeter control periodically samples water and activates the automatic regenerator which begins at first sign of hardness in water.
IS THIS THE RIGHT ANSWER SERVICE?
YES, THIS IS NORM TUCKER AT REFINITE
Problems in WATER TREATMENT are rightly solved when you call in the RIGHT ANSWER people. Refinite's Sales & Service Staff blankets the nation, and there is a representative close enough to give you neighborly service. Merely get in touch with Norm Tucker at Refinite in Omaha. He will have the Refinite man nearest you get the necessary details concerning your problem, and forward to the RIGHT ANSWER Service in Omaha . . . for immediate attention.
Today . . . ask the girl on the switchboard to get Norm Tucker of RIGHT ANSWER Service . . . Ollchard 3000 . . . Omaha. Or, write. Address: Right Answer Service, Refinite Corp., P. O. Box 1312, Omaha, Nebraska.
Refinite
WATER REFINING EQUIPMENT
OMAHA, NEBRASKA

PALMETTO Packings
PALMETTO PACKINGS
BASA HAMMERS
FAVORITE WRENCHES
EMPIRE MALLETS
PICK YOUR WEAPON
HEAT!
CHEMICALS!
PRESSURE!
PALMETTO SUPER SHEAT
. . . TAKES ON ALL COMERS!
This all-service flange and joint sheet packing takes gruelling punishment . . . won't go to pieces when it runs into chemicals, when pressures or temperatures get rough. Structure does it — selected long-fibre asbestos pressure bonded with special heat and chemical resisting bonding agents. Compressible. Resilient. Exceeds Navy and Federal specifications. Standard sheets and gaskets to order.
Write for bulletin SP-19—the single sheet with Palmetto's eight perfect answers to all sheet packing and gasket requirements.
GREENE, TWEED & CO.
NORTH WALES, PENNSYLVANIA
MORAN'S COUPLINGS
"TUSKO" WALRUS POLISHING LEATHER
Contact your fully-stocked Palmetto distributor on all packing problems . . . ask him about our special tools.

are discussed as is vapor and mist problems from wet grinding and machining operations. Cross index permits you to locate the recommended unit, either by known cfm capacity or by general classification of the dust involved. Aget-Detroit Co.

MISCELLANEOUS

270—Lubricant Data Book. The answer to the problem of securing maximum over-all efficiency in lubrication lies in determining the kind and quality of the lubricant, and the method of application that is best suited to each case. This 56-page data book will show you how to select the correct lubricant for a particular application. Lists equipment in almost every industry and gives specific lubrication recommendations along with other valuable information. Fiske Brothers Refining Co.

271—Hydrolubes. Physical properties and advantages as well as how to use these fire-resistant hydraulic fluids are presented in 12-page booklet. Describes their fire-resistance, high viscosity index, low leakage loss, and slight hazard to operators in use. Tables, charts and curves give information in condensed form. Carbide & Carbon Chemicals Div., Union Carbide & Carbon Corp.

272—Corrosion & Rust Control. Tinallium Pro-Tex-It provides corrosion and rust control with rugged lubricating properties for practically all basic materials says 5 pages of data. Contains information on exhaustive tests, a host of recommended applications, several testimonial letters and user reports. American Sand-Banum Co., Inc., Pro-Tex Div.

273—Open Steel Gratings. Technical manual explains the properties of structural steel footwalks, gratings, treads, etc. Illustrations show various applications. Tables give widths and types. William F. Klemp Co.

274—Hydraulic Oil Purifiers. Specially prepared 8-page bulletin presents correct method and equipment to maintain hydraulic oils under the most severe operating conditions. Actual plant photographs and schematic drawings illustrate various applications of the purifiers. Honan-Crane Corp.

275—Coatings. Vinyl plastic coatings for the control of corrosion on steel, concrete, brick and plywood exteriors are described in well illustrated bulletin. Specific properties are given; chemical resistance chart is included; and application information presented. Casey & Case Coating Co.

276—Emulsion Cleaners. Folder describes a series of emulsion cleaners which have been designed to remove both oil-soluble and water-soluble soils from any metal or alloy, without attacking the base metal. Claimed to be harmless to most paint finishes. Detrex Corp.

277—Packing. Profusely illustrated 20-page catalog combines in one booklet the full line of Palmetto packings. Includes the recently introduced packing

for liquid pistons on inside-packed piston pumps. Self-lubricating, molded and sheet packings are covered in detailed text that points up application, structure and performance. Handy selection charts and descriptive tables on size, weights, lengths, etc. are provided. Greene, Tweed & Co.

278 — Hydraulic Cylinders. Complete data relative to most recent developments on Rotocast hydraulic cylinders are presented in 28-page catalog section. List of construction features, mountings, accessories, typical installations along with ample technical and engineering data enables you to determine the type and size which will best meet your requirements. Logansport Machine Co., Inc.

279—Insulating Oil Regeneration. Discussion of contaminating effect of sludge, moisture and carbonized particles on insulating oils is contained in 4-page technical bulletin. Photographs and factual data on centrifugal equipment that restores dielectric strength of such contaminated oils are given. Data on causes and effects of contamination, proper heating of insulating oil and how to rate effectiveness of centrifuges included. The Sharples Corp.

For more information use one of the convenient reply cards on page 117. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you.

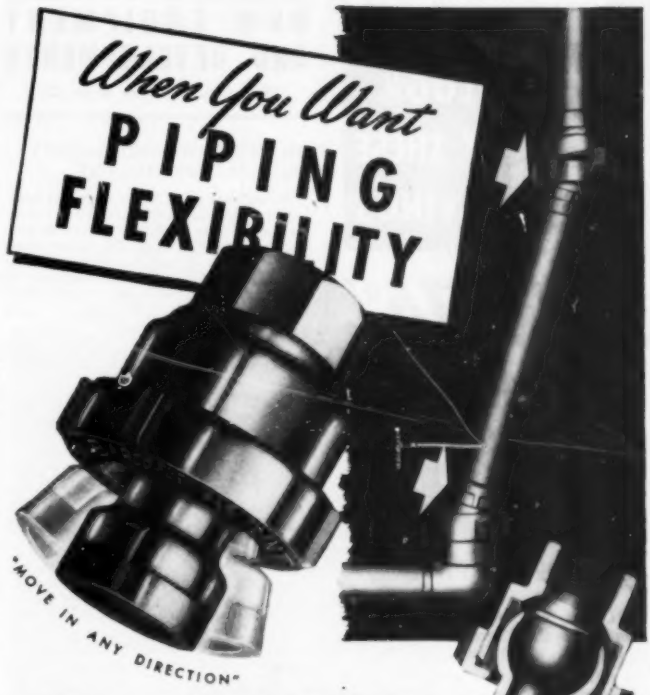
280—Corrosion Proof Linings. Complete line of corrosion proof linings, including: sheet linings, solution or dispersion linings, brick sheathings and miscellaneous linings are described. The Atlas Mineral Products Co.

281—Floor Repair. Method of resurfacing or repairing floors without interrupting plant traffic is described in 2-page bulletin. Plastic product ready for immediate use is recommended for various heavy-duty applications according to the manufacturer. Paramount Industrial Products Co.

282—"Duco" Finishes. "The Story of 'Duco' Finishes" is a 20-page picture story of the discovery and development of modern finishes. Documents the solving of various problems concerned with quick-drying durable finishes. E. I. du Pont de Nemours & Co.

283—Bronze Electrodes. Technical and pertinent information about every bronze electrode produced by Ampco is contained in 24-page reference and instruction book. Recommends welding techniques and procedures, and machining suggestions. Includes convenient charts covering selection and preheating. Ampco Metal, Inc.

284—Maintenance Checking Chart. Aimed specifically at plant and building maintenance superintendents is this 6-page chart. Lists many common building maintenance problems and recommends a solution for each. Over 100 products and processes are available for maintenance of floors, roofs, interior and exterior walls, waterproofing and paints, etc. United Laboratories, Inc.



Use BARCO FLEXIBLE BALL JOINTS

THE SOLUTION FOR MANY PROBLEMS! The BARCO Flexible Ball Joint is one of the most useful, most versatile fittings ever developed for application on piping conveying steam, oil, gas, water, air, chemicals, refrigerants, or other fluids. Find out how these simple, rugged, economical joints can help you:

- **Overcome piping misalignment! Provide simple, trouble-free flexible couplings for steam or air lines.**
- **Provide for movement in piping — up to 40° side flexibility in any direction, plus 360° swivel action. Widely used in loading and unloading lines.**
- **Protect piping against strain, stress, settling, shock, or vibration! Excellent for outside service piping connections to buildings, large storage tanks.**

COMPLETE LINE—15 different sizes, ¼" to 12". Angle or straight, male or female threaded connections—flanged connections—welding ends for welded connections. Available in materials suitable for temperatures from −50° to as high as 1,000° F.; for pressures from vacuum to 750 p.s.i. steam, or 6,000 p.s.i. hydraulic. Fire-proof, pressure-safe! Standard throughout the world—available through leading supply companies.

ENGINEERING RECOMMENDATIONS—Barco factory and field engineers are ready to help you solve your problems. ASK FOR NEW CATALOG NO. 215 "BARCO FLEXIBLE BALL JOINTS."

BARCO MANUFACTURING CO.
1831 D WINNEMAC AVE. CHICAGO 40, ILL.
The Only Truly Complete Line of Flexible, Swivel, and Revolving Joints
FREE ENTERPRISE—THE CORNERSTONE OF AMERICAN PROSPERITY

GE-111-A

LOOK AT THESE SAVINGS

53%...74%

of noble metal thermocouple cost

WITH

ENGELHARD

RECLAIMING PROCESS

ON ONE 30" long platinum thermocouple, the Engelhard Reclaiming Process saved 53% as compared to the cost of a new unit. On another, the saving was 74%. These are typical examples of how Engelhard Reclaiming — including application of scrap value of old noble metal thermoelements against cost —can stretch your equipment dollar. What's more, Engelhard restores old thermoelements to like-new condition . . . in just 48 hours, if necessary.

ENGELHARD also manufactures a line of wide-range thermocouples and accessories to meet your specific conditions of atmosphere and temperature. For complete information on either Repairs and Reclaiming or New Couples, fill out coupon below and mail today.

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Please send me:

☐ Data on Engelhard Reclaiming Process
☐ Free copy of Engelhard Bulletin 330-D

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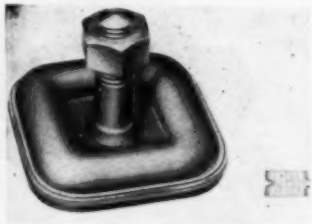
CHARLES ENGELHARD, INC.
850 PASSAIC AVENUE, EAST NEWARK, N. J.

NEW EQUIPMENT AND DEVELOPMENTS

(Continued from page 22)

30—SPIRAL-WOUND GASKETS THAT ARE REUSABLE

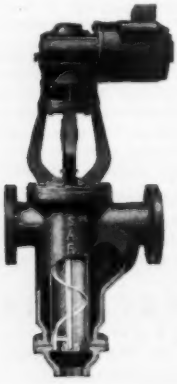
Maintaining perfect seals for boiler handhole and tubecap cover assemblies at a minimum maintenance cost is now possible with the application of Flexitallic Gasket Company's style T gaskets. No compounds are required and the gaskets can frequently be reused if not removed from cover assemblies during outage. This economy results



from the exclusive feature of Flexitallic spiral wound construction—the spiral winding of V-crimped plies alternated with plies of filler. The V-crimp gives the metal strip a strong, resilient action that rebound when they are not under compression. Available in two thicknesses: 0.125 in. for assemblies having narrow seating surfaces and high bonding loads and 0.175 in. for assemblies having broad seating surfaces and low bonding loads. Standard style T gaskets come in the following three ranges of operating pressure for practically all makes of boilers and auxiliary equipment: 0 to 499, 0 to 999 and 1000 psi and above.

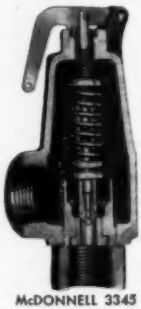
31—LIQUID STRAINER HAS BUILT-IN SCRAPER

Sarco Co., Inc. now are manufacturing pipe line strainers with built-in scraper blades that clean the screen while the fluid is flowing. There is no cause for shutdowns to remove and clean the screen, and the removal of screens is eliminated. This device puts an end to the hazard of screen leakage and permits the use of a closer mesh strainer. It removes solids or scums, without interruption of flow, from any fluid: river water, syrups, hot wax, tar fuel, Bunker C fuel oil, brine, fruit juices, inks, paints, resins and photographic film solvents. Inside the cylindrical screen is a scraper blade, which rotates like a worm gear. This motor-driven blade hugs the inside of the screen and scrapes off the foreign particles as quickly as they are trapped. The body, scraper and screen can be ordered of any suitable metal and the screen can be lined with a metal gauze. Available in sizes 3/4 to 8 in.



32—RELIEF VALVE RATED IN BTU CAPACITY

A moderately priced, large capacity safety relief valve for water heaters and tanks is announced by McDonnell & Miller, Inc. It is designed to prevent excess pressure under conditions that can develop in a hot water system. Each valve is rated in Btu capacity. It is possible to select the valve that will open at the desired pressure and that has capacity equivalent to the heat output of the boiler. All valves are certified for capacity by the National Board of Boiler and Pressure Vessel Inspectors, and bear the official ASME symbol of compliance with the code. Operation is extremely simple. At normal temperature, water is relieved at a low rate, but when temperature rises into the emergency zone the increased velocity acts on a ring, snapping the valve wide open to dissipate heat at full discharge rating.



McDONNELL 3345

33—HAND SAW AIR OPERATED

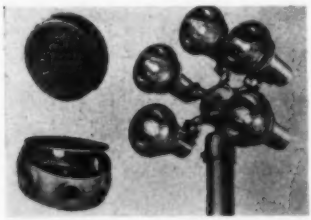
A completely different approach to power sawing was announced today by the Wright Power Saw and Tool Corp. Entirely unlike conventional chain or circular saws, this saw drives twin reciprocating blades over a 4-in. stroke at 1500 strokes per minute with 60 psi compressed air. Because of the dynamic balance derived from the opposed motion of the blades, the saw is free-sawing and there is no thrust or torque. The saw is equally effective for crosscutting, ripping or notching. Sawdust is thrown away from the operator and cannot clog or bind

the blades. Saw teeth can be resharpened and set the same as any handsaw. Other features are: blades can be changed in seconds, 360 degree handle adjustment for cutting in any position, saw stops instantly when spring-loaded throttle is released, alloy steel blades, and low air consumption.

For more information use one of the convenient reply cards on page 117. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you.

34—CLUSTER LIGHTS FOR OUTDOOR PROTECTION

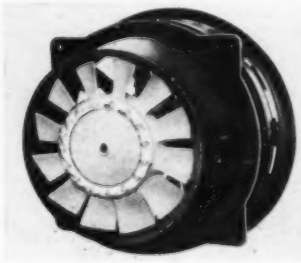
Weatherproof cluster lights for outdoor protection, factory yards, boundary fences and other industrial area floodlighting applications are provided with the Stonco Cluster Box No. 25 announced by Stone



Mfg. Co. Designed to conserve critical aluminum, the unit combines tough aluminum alloys that are precision die-cast under tremendous pressure to provide structural strength with less aluminum. A removable cast aluminum cover with a heavy cork gasket provides quick, easy access to inside wiring and speeds up installation. Each box has six ½ ips tapped holes to take from one to five standard lampholders for 150, 200 and 300-w outdoor weatherproof reflector bulbs, which are available as standard stock from all major lamp and bulb manufacturers.

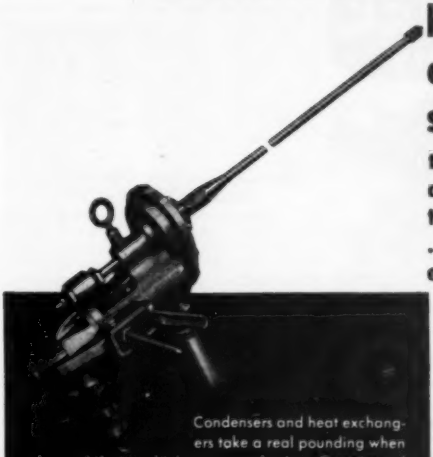
35—OIL BURNER HAS STEAM ATOMIZATION

Coppus Engineering Corp. has announced the marketing of a Coppus-Dennis Oil burner, which is said to have six major advantages. This burner utilizes steam under pressure to atomize oil into the smallest possible particles that are discharged through rapidly rotating orifices and then thrown outward into a cylindrical "sleeve" of air. Air-fuel mixture is projected into the furnace by a fan, which is rotated by the jet reactions of the steam-atomized oil. Violent mechanical mixing of the atomized oil and



AIRETOOL helps heat transfer equipment stand the gaff

these tools assure thorough cleaning . . . more accurate expanding



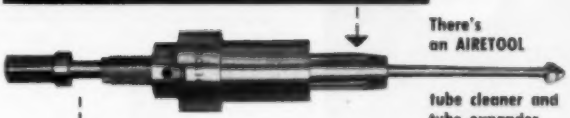
Condensers and heat exchangers take a real pounding when plants shift into high-gear production. Experienced maintenance crews have learned to rely on AIRETOOL tube cleaners and tube expanders to keep down-time to a bare minimum. They know it costs less to give a tube AIRETOOL care than to replace it.

SPECIAL CONDENSER CLEANER FEATURES

. . . These cleaners are outside mounted . . . have a handle valve that gives operator quick positive control . . . a water-feeding device to keep drill head cool . . . sturdy, lightweight alloy aluminum construction . . . and a variety of drill heads to meet any scale condition.

SPECIAL EXPANDER FEATURES

These ball bearing type expanders have many construction features such as a special retainer which securely encases ball bearings . . . separate ground, grooved raceways on which the thrust is equally distributed to prevent bearing breakage . . . tapered bevel-nosed rolls to produce smooth unridged surfaces.



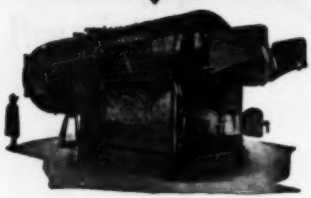
There's an AIRETOOL tube cleaner and tube expander for every type of tubular construction

For advice on any tube maintenance problem, write The AIRETOOL Mfg. Co., 318 S. Center St. Springfield, Ohio.

AIRETOOL
MANUFACTURING COMPANY
SPRINGFIELD, OHIO

BRANCH OFFICES:
New York, Philadelphia, Chicago, Houston, Tulsa, Baton Rouge

KEWANEE
HEAVY-DUTY



10 to 304 hp
100, 125 and 150 lbs wp

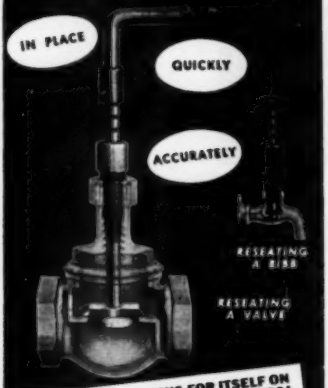
Has all the characteristics which make firebox boilers ideal for high pressure. Complies fully with ASME and SBI codes.

Outstanding for extra years of dependable service in producing hi-pressure steam economically with Oil, Gas or Coal.

WRITE Department 96-D2 749
for 4" scale with pipe diameter markings

KEWANEE BOILER CORPORATION
KEWANEE, ILLINOIS

RESEAT VALVES AND BIBBS



PAYS FOR ITSELF ON FIRST 2 OR 3 JOBS!
Don't junk expensive globe or angle valves, bibbs, fixtures — reseat them! Order Skinner *Valve and Bibb Reseater*. Easy to use. Guaranteed cutters leave seat glass-smooth, level, tight.
1/4" to 2" $32.50
1/4" to 3" $45.00

M. B. SKINNER CO.
SOUTH BEND 21, INDIANA, U.S.A.

air brings the oxygen molecules together with the hydrocarbon molecules of the fuel, resulting in rapid and complete combustion and consequently a very short flame pattern. Advantages resulting from this design are as follows: (1) boiler rating is increased, (2) fuel efficiency is improved, (3) hot spots are eliminated, (4) no forced draft equipment is required, (5) stack requirements are cut, (6) coking of atomizers is reduced.

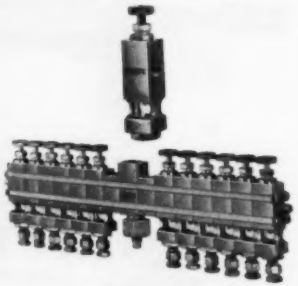
36—DISCHARGE TRACKS INCREASE CAPACITY

Adaptable to the handling of many types of parts, ranging in size from tiny rivets to mower blades, the feeding capacity of Syntron Company's vibratory parts feeders can be doubled or tripled by equipping them

with two or three feeding tracks instead of one which was originally furnished. Movement of parts is in the same direction on all tracks and the discharges may be located all at one point or at various points around the circumference of the bowl, convenient to the processing stations. Two or more tracked part feeders not only increase rate of feed, but also permit addition of more processing stations and counting devices. Models EB-01 and EB-1 can be furnished with two feeding tracks, while Models EB-2 and EB-5 can be equipped with four feeding tracks.

37—ANGLE SIGHT VALVE COMES IN TWO STYLES

A supplement to Oil-Rite Corporation's straight sight feed valves style SFN, for pressure or gravity oiling systems, permits a manufacturer to construct his own oiling system at low cost. These valves have ex-

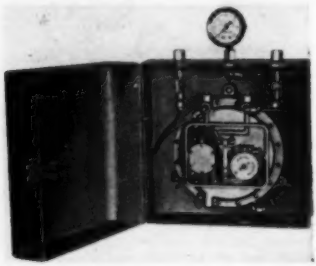


tremely free-flow characteristics and allow the flow of oil to be visually checked and closely regulated. They can be used singly or gang mounted, are equipped with needle valve control, and regulate oil flow from full flow to a complete shut-off. Smooth easy hairline adjustments can be made and retained through the use of a friction screw. Gang mounted sight feed valves permit multiple oiling controlled from a central point. Oil from a reservoir or pump is fed through the valves to a number of individual bearings requiring lubrication, thus replacing from 2 to 24 oilers. Oil fed to each bearing can be individually adjusted and observed at one station.

For more information use one of the convenient reply cards on page 117. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you.

38—INSTRUMENT CONTROLS AIR VELOCITY

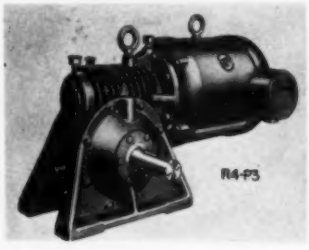
A proportional action for controlling air velocities ranging from 50 to 250 fpm, has been developed by Johnson Service Co. Operation of the instrument is based on the



fact that the velocity of air, moving between two points, is proportional to the difference in pressure between those points. This regulator responds to pressure variations of 0.0001 in. water gage and controls velocities within plus or minus 10 fpm. Control pressure increases in direct proportion to the increase in velocity.

39—GEAR MOTOR LINE IS VENTILATED

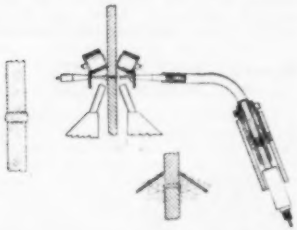
The Janette Mfg. Co. announces a line of ventilated integral horsepower gear-motors. With this addition, the entire Janette line now includes ventilated, enclosed and totally enclosed fan-cooled types of gear motors. Single phase type motors are available in 1-hp and smaller ratings; polyphase and direct current motors are available through 7½-hp. Within a short time, integral horsepower, class 2 gear-motors will be available for use in explosive atmospheres. Designed for maximum flexibility of mounting, the gear-motors are both easy and inexpensive to assemble on any apparatus. Six types and sixteen sizes of gear boxes are available that can be furnished



with motors. These gear boxes include gear combinations for either single or double reduction, and either worm gear of combination worm-and-planetary gears.

40—AUTOMATIC WELDS MADE IN 3 O'CLOCK POSITION

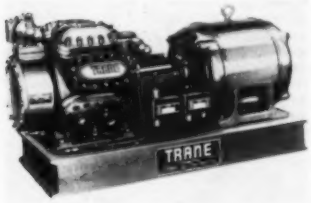
Horizontal welds made on vertical plate by the submerged melt process have been limited to special setups. Equipment introduced by The Lincoln Electric Co. extends the advantages of the process to joint



positions other than downhand. Automatic heads travel along a stationary seam. The flux is carried on a belt whose top side is stationary so that the flux does not move although belt and pulleys travel with the head. Welds can be made from one side with backup if necessary, or from both sides simultaneously without backup. Distortion and cracking are minimized. Good penetration allows less current and smaller electrode. Irregular contours can be followed. The process is ideal for fabricating pipe, box-sections, beams and large storage tanks.

41—FREON COMPRESSORS OPERATE QUIETLY

New standards of quiet, vibration-free operation, low operating and maintenance costs and long-wearing surfaces are incorporated in The Trane Company's line of reciprocating compressors. Designed for comfort and process air conditioning appli-



cations, the compressors are built in 10, 15, 20, 25, 40 and 50 ton capacities. Complete condensing units are made in each size. No special foundations, floor construction or soundproofing is required. Contributing to smooth operations is the cylindrical body design; "V" and "W" arrangements of the four, six and eight cylinder models; counter balancing of all reciprocating forces; static and dynamic balancing of crankshafts, and reduction of moving weight through aluminum pistons and connecting rods. Noise is reduced through use of plastic cushioned valves, aerodynamically designed suction and discharge gas passages and location of all parts of the capacity control system within the compact, cylindrical body.

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Liquid Level Readings
AT REMOTE POINTS
with the
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TRUSCALE
GAGE

Available with Visible and Audible Alarms and Repeators at auxiliary points.

THE Jerguson Truscale Gage reproduces your boiler water, deaerating tank, or other liquid level at remote points with accuracy as close as ½ of 1%. This is made possible by a design which transmits movement changes in a mercury-filled manometer through a specially designed featherlight pointer system. A unique magnetic coupling, with a magnetically energized yoke operating on precision bearings, uses the maximum of coupling force available with a minimum of inertia in the pointer system.

The extreme sensitivity and close accuracy of the Jerguson Truscale Gage gives you *dependable liquid level readings at remote points.* The Truscale Gage has a built-in adjustment for easy calibration for any W.S.P. The dial is illuminated, the scale markings and pointer glow in the dark, and the gage is available with visible and audible alarms.

Investigate this exceptional remote reading liquid level gage. Write for data unit on Jerguson Truscale Gage.

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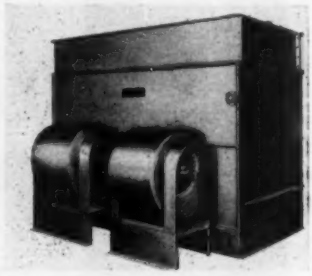
42—COOLING TOWER COMES IN TWO SERIES

The Binks Mfg. Co. announces the development of an improved Dry-Fan cooling tower that is of the blower type and manufactured in two models. The 2-B series is a single fan model available in 9 sizes, with capacities ranging from 3 to 30 ton of refrigeration. The smallest tower in the 2-B series is 2 x 2 x 6 ft, the largest 6 x 6 x 7 ft 6 in. These towers are extremely compact, highly efficient, and exceptionally quiet.



Air enters through a squirrel cage type fan at the bottom and is exhausted through redwood drift eliminators at the top. The 2-BB series are equipped with 2 double-inlet squirrel cage blowers. These towers are made in 4 sizes with capacities ranging from 52 to 60 ton of refrigeration. They range in size from 4 ft 6 in. x 9 ft 0 in. x 7 ft 6 in. to 6 ft 6 in. x 11 ft 0 in. x 7 ft 6 in. Both towers are built and operate on the same principles and offer the same features.

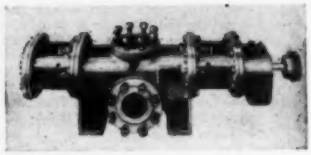
43—CONTROL STATIONS ARE OIL-TIGHT

Control stations with 12-unit enclosures have been added to the Oil-Tite line by the Westinghouse Electric Corp. Class 15-022, Type OT pushbuttons, for machine tool control and other heavy-duty installations, are

now available in stations accommodating 1, 2, 3, 4, 6, 9 and 12 units. A resilient cork-neoprene gasket provides a seal against oil, coolant, cutting compound and water. Five types of operator heads, with matching pilot lights, provide for unit flexibility.

44—SCREW PUMP HAS POSITIVE DISPLACEMENT

An external gear and bearing bracket type screw pump for positive displacement of non-lubricating liquids for all viscosities at 1 to 700 gpm, is announced by the Sier-Bath Gear Pump Co., Inc. The pump's single-point alignment, dual-controlled rotors, and other features provide greater durability, easier installation and faster servicing.



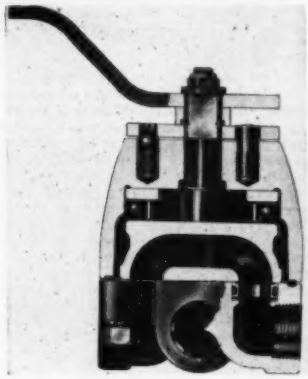
The pump can be direct-connected up to 1800 rpm. Available in horizontal or vertical construction, in corrosion resistant alloys and with steam jacketed bodies, special stuffing boxes and bearings for high temperature applications. Hopper type bodies are available for extremely high viscosities.

45—RECORDER MEASURES ROTOR TEMPERATURE

An electronic recorder for accurately and quickly measuring temperatures in large electric generators has been developed by Minneapolis-Honeywell Regulator Co. This device has been designed to provide a better and more economical instrument to assist operators in avoiding overloads. In addition, the instrument furnishes a 12-in. strip chart record, which can be used as a guide for gradually cooling a generator. The recorder has a range of 0 to 150 C, a limit error of 1.5 degrees, a dead zone of 0.3 degrees and a pen speed of 1.4 minutes full scale. Range of rotor winding resistance is 0.1 to 4.0 ohms, and it has a dielectric test of 1,500-rms for one minute. In designing the instrument special consideration was given to users who, generating large volumes of their own power, want maximum safety and dependability for peak capacity operation. The recorder is made as a special product with deliveries in about 90 to 120 days from receipt of orders.

46—HOSE COUPLING HAS PRESS-LOCK

Through employment of an entirely new hose-to-coupling anchoring principle, the coupling manufactured by Mulconroy Co., assures greater strength, safety and efficiency. The hose provides a major portion of the coupling's tremendous holding power through application of the principle that rubber in mass form, while not compressible, can be displaced under pressure. Coupling consists of three parts: (1) corrugated stem with wide hex section, male iron pipe thread (or special thread) and collar to engage sleeve, (2) sleeve extending full length of stem, with forward end shaped inward to engage stem collar, and other end

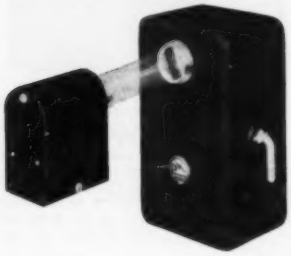


flared to assist flexing of hose and (3) locking ring between collar and anchoring flange of sleeve. Made of steel, in sizes to fit hose from 3/16 to 2 in. and available in connection with Mulconroy hydraulic hose assemblies, or attached at factory to customer's hose.

For more information use one of the convenient reply cards on page 117. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you.

47—PHOTOELECTRIC CONTROL HAS DELAYED ACTION

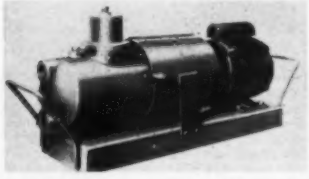
The jamming of cases or cartons on conveyer lines can now be prevented with Photoswitch Inc. delayed action photoelectric control set P1D. This device was designed to indicate the presence of a jam and to intro-



duce conveyer stop motion or other correction. The unit combines a high-speed photoelectric circuit with an electronic delayed action timer in a single control to limit relay. The relay operates only when the light beam has been broken for a preset time interval representing a period longer than that normally required for a case to pass. Since relay armature motion is the only mechanical action which takes place, this reduction of its frequency of operation multiplies the life of the equipment.

48—REFRIGERATION PUMP FOR TEST WORK

Beach-Russ Co. now manufactures a two-stage vacuum pump for dehydrating and testing refrigeration and air conditioning units. This unit replaces the old style Beach-Russ duplex test pump widely used for testing



and dehydrating purposes. It is lighter, more compact, provides a faster pump down and better vacuum and is much easier to handle and operate. The pump blanks off at 1/10 mm., or 100 microns, weighs only 80 lb and has an over-all length of 28 in. Drive is by a 1/3 hp motor with any desired current characteristics. Pump lubrication is automatic. This vacuum pump has many other field applications, it is portable and has the ability to handle water vapor at a relatively high vacuum suitable for laboratory, pilot plant and field test jobs.

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• DIRECT HEATING OF LIQUIDS

If your plant requires

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TRADE MARK REGISTERED

The Drip-less Crane Motor Lubricant

NON-FLUID OIL stops oil showers from overhead cranes. Its exclusive adhesive properties enables it to stay in bearings and off tracks, pillars and products. Thus, NON-FLUID OIL lessens fire hazards, reduces stock cleaning costs, and lowers oil and application costs.

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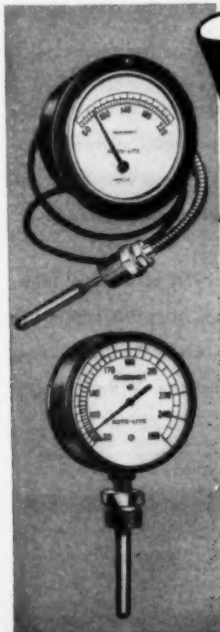
NON-FLUID OIL is not the name of a general class of lubricants, but is a specific product of our manufacture.



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Auto-Lite Thermometers are designed to give you the broadest selection for your needs: Priced low and precision-made for accuracy, these instruments point the way to temperature savings and help to prevent spoilage. Write for catalog showing the many styles and types of Auto-Lite Thermometers that are available.

TYPICAL APPLICATIONS: STORAGE TANKS & ROOMS, COOLERS, DRYERS, AIR CONDITIONING, PILOT PLANTS.

Illustrated, at top: Model G Indicating Thermometer, flush mounting type with capillary tubing for remote reading. Priced from $18. At bottom: Model V Thermometer (vapor pressure type). Rigid stem for direct mounting. Priced from $10.25.

THE ELECTRIC AUTO-LITE COMPANY

INSTRUMENT AND GAUGE DIVISION, DEPT. M-8

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INDICATING & RECORDING THERMOMETERS

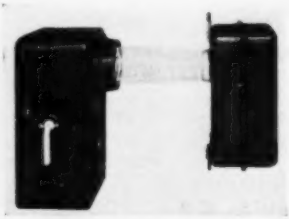
49—IMPACT TOOLS ARE AIR OPERATED

Ingersoll-Rand Co. has added two air operated Impactools, size 504 for nut running up to ⅜ in. bolt size, and size 510 for nut running up to ¾ in. bolt size. Both tools are pistol grip type, streamlined and well balanced for ease of operation. Easy-

to-grip reverse caps are deeply grooved so the tools may quickly be reversed even with greasy hands. Palm-fitting pistol grip handles afford comfortable operation over long periods of time. To save time on assembly line operations, both tools have a high run-down speed before impacting starts. Small vane type air motors give all the speed and power needed to handle difficult nut running jobs.

50—SMOKE DETECTOR FOR AIR CONDITIONING SYSTEM

Photoswitch Inc. announces a photoelectric smoke detector for an air duct system. It is recommended for use in stores, theaters, hotels and other locations where the presence of smoke is a hazard to property or a possible



cause of panic. At the first sign of smoke type A28E smoke detector operates auxiliary relays and may automatically turn off blowers, close automatic shutters or signal the maintenance department. Among the features of this system are a sensitive photoelectric circuit with fail-safe circuit design and a tamper-proof sensitivity control to prevent unauthorized adjustments.

51—TANK CLEANER IS ON WHEELS

Ideal Industries, Inc., announces an all-purpose tank type cleaner for industrial and commercial establishments. It is a 3-in-1 combination giving the operator a vacuum cleaner, water pick-up and powerful hand type cleaner or blower. Used as a tank cleaner it picks up dirt, dust and metal

particles from all types of floors. It quickly removes water from factory floors after mopping. When the power unit is removed from the tank, it becomes a blower and is extremely valuable in blowing out dirt. With

a spray attachment it serves as a smooth even sprayer for paints, lacquer and deodorant. It consists of a 12-gal tank set on four large easy rolling caster wheels, which give it excellent stability. Available in two models, heavy duty (1-1/3-hp) and medium duty (2/3-hp).

For more information use one of the convenient reply cards on page 117. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you.

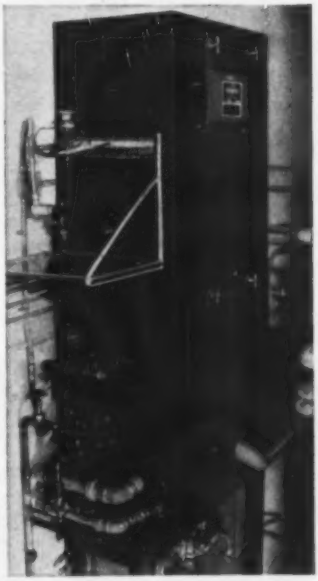
52—MEASURING DEVICE HAS SUBMERGED PLUMMET

A direct indicating Demsitrol has been added to Precision Thermometer and Instrument Company's line of liquid density measuring instruments. Designed to eliminate errors caused by liquid and gas interface in usual hydrometers, this instrument proves most valuable, not only where periodic checks of liquid must be made, but where process peculiarities such as excessive corrosiveness and inflammability may prevent

drawing samples from the system. The instrument operates as a single by-pass in any liquid line or vessel and specific gravity may be read directly as required. A totally submerged chain weighted plummet is used as the measuring element. The plummet is self centering, operates without friction and will not stick to the sides of the chamber. The reading scale is marked boldly and is read across a single reference line on the plummet. Length of scale is 5 in. Models are available with or without a thermometer, calibrated directly in terms of temperature correction, mounted on the chamber. Suitable for high or low temperature or vacuum service, these devices can be constructed from a wide variety of materials.

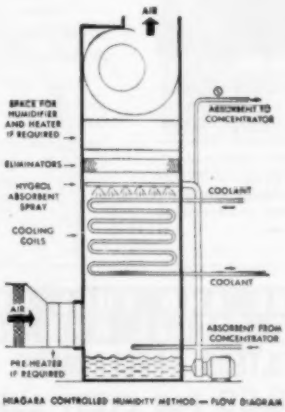
New "Controlled Humidity" Method Gives a Better Solution to Air Conditioning Problems

"Hygrol" Absorbent Liquid Dehumidifies Fresh Air Without Refrigeration



NIAGARA Air Conditioners or Dehumidifiers using "Hygrol" liquid absorbent give precise control of air temperature and humidity...at lower operating cost, with large savings in space and with smaller and less expensive equipment, in many applications.

This method dehumidifies the air by passing it through a chamber in which "Hygrol" spray removes its moisture and produces a low dew point. The "Hygrol" solution resulting is continuously and automatically re-concentrated, providing always full capacity in air conditioning and assuring always a constant dehumidifying capacity and a trustworthy, constant condition for your material, apparatus, process or room to be conditioned.



NIAGARA CONTROLLED HUMIDITY METHOD — FLOW DIAGRAM

"Hygrol" is a liquid, not a salt solution; it stays pure and non-corrosive; it does not cause maintenance or operating troubles in food plants or in chemical processes.

Investigate this new Niagara Method for "comfort" air conditioning as well as to protect quality in hygroscopic material, or processes or instruments, or to prevent condensation damage to metals, parts or products.

Write for Bulletin 112

NIAGARA BLOWER COMPANY

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Experienced District Engineers in all Principal Cities

"SPOT" NEWS OF INDUSTRY

(Continued from page 115)

(7) Congress to complete a study to determine whether continuance of present government monopoly in general and special purpose rubbers is in our national security interests.

Engineers Attend Service School To Study Packaged "Controlled Recirculation" Boiler

More than 200 diesel locomotives hauling some of America's crack passenger trains have, for the past five years, been equipped with Controlled Recirculation steam generators to supply steam heat for the cars. Having proved their performance under extreme conditions of heat and cold, accompanied by the jarring and vibration of locomotive service, these steam generators are now being offered for industrial applications by Combustion Engineering-Superheater, Inc.

In conjunction with this marketing program, the company is inviting engineering and other personnel from industrial and commercial firms to attend a service school at its East Chicago, Ind., plant to study the design characteristics and operating performance of the units.

Operating principles of packaged Self-Contained "Controlled Recirculation" steam generator are studied at Combustion Engineering — Superheater's service school. In this group (left to right) are Arthur Ladsverk, Combustion's engineer-instructor; C. L. Westendorf, service engineer, E. I. DuPont de Nemours; Robert McCue, electrical engineer, Stocker Mfg. Co.; B. S. Norling, design engineer, E. I. DuPont de Nemours; and Frank Dilanni, maintenance supervisor, Riggio Tobacco Corp.

Known as the "CE Controlled Recirculation" steam generator, it is actually a packaged self-contained steam plant that includes feedwater pump and control, fuel equipment and control, combustion control and safety devices, forced-draft fan, safety valves, circulating pump, and all other auxiliaries. Shipped from the factory as a complete assembly, it can be installed with a minimum of construction, and usually requires connection only to steam, fuel, water, and electrical service outlets. It is available in several sizes for steam capacities from 2,800 to 6,000 lb of steam per hr and for operating pressures up to 300 psig.

The generator may be fired by light or heavy fuel oil or by natural gas. The 6,000-lb capacity unit for burning light oil or gas occupies a space 6 ft 11 in. long by 5 ft 5 in. wide, and is 6 ft 11 in. high; the unit for burning heavy oil is only slightly larger.

This steam generator operates on the forced recirculation principle, whereby a circulating pump forces hot water through all the elements of the generator, keeping the hot water in the system at steam temperature. While the generator is in operation, the quantity of water circulating is constant, regardless of steam output. At maximum capacity, the quantity of water circulated is approximately ten times the amount of steam produced. The controlled recirculation principle is reported to assure peak efficiency in heat transfer and to eliminate scale formation.

In operation, fuel is fed to and burned in a radiant or combustion chamber section, after which the hot gases pass through a convection section fitted with a series of baffles. The heating surface of the radiant section is so arranged that the watertube elements form the envelope of the combustion chamber; each element is connected to inlet and outlet headers. The convection section consists of a number of watertube elements each of which is also connected to the inlet and outlet headers. Each element of both sections is equipped with an orifice at the inlet end to insure proper distribution of the circulated water.

Steel Companies Will Spend More Than A Billion Dollars for Expansion in 1951

About $1.7 billion will be spent on expansion and improvement in the steel industry in 1950 and 1951, the American Iron and Steel Institute has announced. Iron and steel companies spent about $513 million last year. They plan to spend $1.2 billion, a record high amount, this year, according to the institute.

Last year the outlay was one of the largest in the history

(Continued on page 146)

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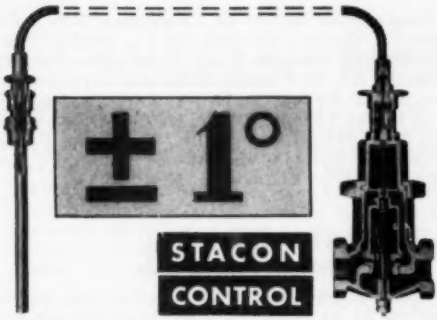

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of the industry. This year's estimated outlay will be 134 per cent higher than the amount spent in 1950 and 307 per cent above the expenditures in 1941.

The 1950 and 1951 figures were reported for 115 iron and steel companies. Since many of these make no raw steel, their outlay is for better finishing facilities. About 35 to 40 companies are engaged in increasing their iron and steel-making capacities. Steelmaking furnaces at the end of 1952 will be able to make more than 117,500,000 tons annually at full production, compared with 104,229,650 tons a year at present.

Franklin Institute Establishes National Asphalt Research Center in Philadelphia

Establishment of a National Asphalt Research Center by the Franklin Institute Laboratories for Research and Development, took place in Philadelphia last month. The new center will serve the asphalt industry throughout the United States.

More than 20 prominent corporations are sponsoring the new organization. These firms, representing the oil, roofing, molded products, sealing compounds, and allied industries, are as follows: Armstrong Cork Co., Lancaster, Pa.; Atlantic Refining Co., Philadelphia; Bird & Son, Inc., East Walpole, Mass.; Certain-Teed Products Corp., Ardmore, Pa.; Cities Service Research & Development Co., New York City; Flintkote Co., New York City; Globe Oil & Refining Co., Wichita, Kans.; Gulf Research & Development Co., Pittsburgh; Hood Rubber Co., Watertown, Mass.; The Lehon Co., Chicago; The Ohio Oil Co., Findlay, Ohio; Owens-Corning Fiberglass Corp., Toledo; The Paraffine Companies, Inc., San Francisco; Richardson Co., Cincinnati, Ohio; Sinclair Refining Co., New York City; Standard Oil Co. of Indiana, Chicago; Standard Oil Co. of Ohio, Cleveland; Stokes Molded Products, Inc., Trenton, N. J.; Sun Oil Co., Philadelphia; Western Molded Products, Inc., Los Angeles; and Witco Chemical Co., New York City.

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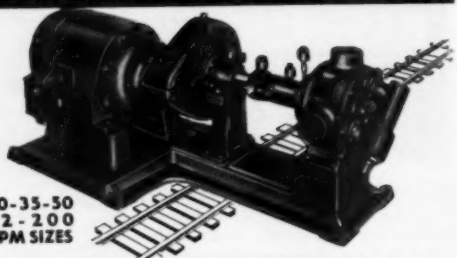

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Canada Ships 65-Ton Steel Ingots At 1600 F Ready for Forging Mills

Canada's largest ingots, 130,000 pounds of steel, are now being shipped hot for the first time. The method, now successfully developed, marks the first known occasion when white-hot ingots were transported such distances by any means. The shipments of steel leave the open hearth department of Dominion Iron & Steel's plant at Sydney, Nova Scotia, and are delivered 200 miles away at Trenton, N.S., some 20 hours later.

The molten steel for the 65-ton ingot, or smaller ingots, is poured and allowed to stand until the steel solidifies but remains white-hot. The huge ingot is then stripped from its mold, and lowered into a special, insulated steel box carefully filled and anchored to a flat car. Held in place in the box by pre-molded supports, remaining space in the box is filled with loose Vermiculite to keep the steel from cooling.

Key Construction Personnel Named for Kentucky Atomic Energy Project

F. H. McGraw & Co. has named Donald W. Neville, v-p, to head up the company's new $350,000,000 construction project for the Atomic Energy Commission at Paducah, Kentucky. The project, which was announced by the AEC recently, involves the largest single construction contract ever awarded to a construction company. It will require nearly 10,000 men and will take more than two years to complete.

Paul F. Pape and Hinman Root of McGraw's New York office will serve as project engineer and chief of purchases, respectively, and A. A. Persson, veteran McGraw construction manager, will be project manager. Mr. Neville and Mr. Persson are regularly assigned to McGraw's Chicago office. In addition to assigning many of its own key men to the job, the company will utilize all the manpower available in the Kentucky area and many men will be sought in and around New York.

Transformers Several Times Larger Described as Economic Possibilities

Construction of giant transformers much larger than those now in use is possible and practical, an Allis Chalmers Manufacturing Co., engineer has reported. W. C. Sealey of Milwaukee, Wis., addressing a technical session of the winter meeting of the American Institute of Electrical Engineers, described construction of the largest 60-cycle transformer core ever made and said, "If this core were used for an oil-immersed power transformer, windings for continuous operation at 2,000,000 kva could be placed on it." The core is now used on a 300,000,000 volt betatron at the University of Illinois.

Cores of that size cannot be shipped by rail but must be assembled in the field, he pointed out, and require a large investment; however, power losses would be half the losses of sixteen 125,000 kva transformers, and weight of the single giant would be half of that of the sixteen 125,000 kva units.

AVAILABLE REPRINTS

Special reprints are now available of the big, 24-page report on SELF-CONTAINED PACKAGED STEAM GENERATORS which appeared in the November, 1950 issue of INDUSTRY AND POWER. Contains finger-tip data on Advantages; Fire-tube Types; Watertube Types; Safety and Operating Controls; Oil Firing Equipment; Operation and Maintenance; Starting-Up Suggestions; Maintenance of Heavy-Oil Pumps; Service Hints; Shutdown Suggestions; Typical Applications. 1 to 19 copies 25¢ each. 20 or more copies at only 20¢ each. These reprints available only while present stock lasts.

Reprints of the following popular articles from INDUSTRY AND POWER are available free of charge. Send your requests to Readers' Service Dept., **Industry and Power,** St. Joseph, Michigan.

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"Chain Belt's Newest Boiler is First 'Step' in 3-Step Plan", October, 1949.
W. J. Theuerman
"Correct Plans Consider Future Expansion Too", December, 1950.
R. L. Harmer and L. D. Bechtel
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"Diesels In A Hydroelectric System", June, 1950.
"Electro-Motive's Steam Plant is Tops in Modernity", September, 1949.
V. L. Wesby
"Engineers 'Raise the Roof' for Harnischfeger's New Boiler", December, 1949.
Anthony Sinclair
"Falls City Production Not Hampered During Recent DC to AC Changeover", July, 1950.
"Gage Glasses, Their Composition and Selection", July, 1950.
"GM 'Utilities' Receive Major Attention", September, 1949.
H. R. Smith
"Grievances Can Be Avoided", April, 1950.
"Harbor Plant Pioneers in Pneumatic Build-Up Refractory", December, 1950.
"How To Select Correct Steam Trap", January, 1950.
Thomas Trail
"How To Select Corrugated Expansion Joints", June, 1950.
"Insulation on 2000 psi Boiler Proves Effective", October, 1949.
R. H. Boothby
"Keep It Clean, says Oldsmobile", May, 1949.
R. H. Barlow and W. E. Rasmussen
"A Lamson Installation", August, 1949.
Calvin A. Burton
"Low Cost Auxiliary Power From Turbine Drives", April, 1950.
"Monsanto Builds Ideal Process Steam Plant at Everett, Mass.", June, 1950.
"Petoskey Diesel Plant Designed With An 'Eye-to-The-Future' ", May, 1949.
"Progress Being Made In Shale-To-Oil Program", November, 1949.
R. A. Catlell
"Qualifications of an Effective Industrial Supervisor", June, 1949.
A A. Potter
"Select Correct Batteries for Starting Diesels", November, 1949.
K. A. Vaughn
"Signode Plant 'Pressurized' to Eliminate Cold Drafts", November, 1949.
"Simplify Determinations of Pipeline Pressure Losses", November, 1949.
I. O. Mullen and H. D. Fisher
"Steam, Air, and Power for 3 New Ford Assembly Plants", May, 1949.
R. M. Doering
"The Story of Thermal Electric", March, 1949.
A G. Purdue
"Supervisors Must Develop Favorable Group Attitudes", November, 1949.
Edmund Mottershead
"Supervisor's Personal Check-Up Chart", November, 1949.
"Synchronous Motors Do Two Jobs at One Time", February, 1950.
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ADVERTISERS' INDEX

Where an * appears after a name the advertisement does not appear in this issue, but appeared in previous issues.

Acheson Colloids Corp. 51
Aerotec Corp., The 68
Airetool Manufacturing Co. 137
Albert Pipe Supply Co., Inc. ..... *
Alemite Div., Stewart-Warner Corp. ... 27
Alloy Steel Products Co., Inc. ..... *
American Brass Co., The 65
American Brass Co., The, American Metal Hose Branch 65
American Engineering Co. 55
Ames Iron Works 112
Anderson Co., The V. D. ..... *
Armstrong Machine Works ..Second Cover
Arrow-Hart & Hegeman Electric Co. .... *
Atlantic Metal Hose Co. 145
Aurora Pump Co. ..... *

Babcock & Wilcox Co., The ..... *
Babcock & Wilcox Tube Co., The ..... *
Bacharach Industrial Instrument Co. ... *
Baldwin-Hill Co. 111
Bareo Manufacturing Co. 135
Beaumont Birch Co. ..... *
Belco Industrial Equipment Div. 126
Bersworth Chemical Co. 114
Betz, W. H. & L. D. 13
Bigelow Co., The 104
Breuer Electric Mfg. Co. ..... *
Buell Engineering Co., Inc. ..... *
Bussmann Mfg. Co. 14, 15
Byron Jackson Co., Pump Div. 59

Chapman Valve Mfg. Co., The 45
Chatillon, John & Sons 38
Chicago Metal Hose Corp. ..... *
Chicago Pneumatic Tool Co. ..... *
Chiksan Co. 30
Childers Mfg. Co. 49
Cleaver-Brooks Co. 63
Clements Mfg. Co. 131
Cochrane Corp. ..... *
Combustion Control Corp. ..... *
Combustion Engineering-Superheater, Inc. ..... *
Cooper-Bessemer Corp., The ..... *
Coppus Engineering Corp. 25
Crane Co. 52
Crane Packing Co. 130
Cuno Engineering Corp. ..... *
Cyclotherm Corp. ..... *

Dampney Company of America, The .... *
Darling Valve & Mfg. Co. ..... *
Dart Mfg. Co., E. M. ..... *
Dayton Rubber Co., The 8, 9
Dearborn Chemical Co. 119
Derrick & Hoist Co., Inc. 128
Detroit Stoker Co. 18, 19
Drew and Co., Inc. E. F. ..... *

Economy Fuse and Mfg. Co. 48
Edwards Valves, Inc., Subsidiary of Rockwell Mfg. Co. ..... *
Electric Auto-Lite Co., The 142
Elgin Softener Corp. ..... *
Elliott Co., Roto Div. 121
Engineer Co., The 17
Englehard, Inc., Charles 138
Erie City Iron Works 7
Eriez Manufacturing Co. ..... *
Everlasting Valve Co. 125

Fairbanks Co., The ..... *
Farris Stacon Corp. 145
Fiske Brothers Refining Co. ..... *
Flexrock Co. 131
Fluor Corp., Ltd., The ..... *
Food Machinery & Chemical Corp. ..... *
Foster Wheeler Corp. ..... *
Foxboro Co., The ..... *
Fuller Co. ..... *

Gates Rubber Co., The 67
General Coal Co. ..... *
General Filter Co. 132
General Motors Corp. Hyatt Bearing Div. ..... *
Golden Anderson Valve Specialty Co. ... 133
Goodyear Tire & Rubber Co., The ..... *
Graver Tank & Mfg. Co. ..... *
Graver Water Conditioning Co. ..... *
Green Fuel Economizer Co. ..... *
Greene, Tweed & Co. 134
Grinnell Co., Inc. 34
Griscom-Russell Co., Inc. 99

Hajoca Corp. 114
Hapman-Dutton Co. ..... *
Hartzell Propeller Fan Co. ..... *
Hays Corp., The 62
Henszey Co. ..... *
Hewitt-Robbins, Inc. 123
Hilliard Corp., The 144
Hoffman Combustion Engineering Co. ..... *
Hoffman Specialty Co. ..... *
Hotel Kay 149
Houghton & Co., E. F. ..... *
Hungerford & Terry, Inc. 131
Hyatt Bearings Div., General Motors Corp. ..... *

Ideal Industries, Inc. ..... *
Illinois Engineering Co., Inc. ..... *
Ingersoll-Rand Co. 4
International Nickel Co., Inc., The 44
I-T-E Circuit Breaker Co. 32, 166

Jeffrey Manufacturing Co., The 60
Jenkins Bros. 10
Jerguson Gage & Valve Co. 139
Johns-Manville ..... *
Johnston Brothers, Inc. ..... *

Kewanee Boiler Corp. 138
Key Co., The ..... *
Kirk & Blum Mfg. Co., The ..... *

Leslie Co. 115
Linde Air Products, A Division of Union Carbide and Carbon Corp. 50
Link-Belt Co. ..... *
Liquidometer Corp., The 126
Lubriplate Div., Fiske Bros. Refining Co. ..... *
Ludwig Associates, F. G. 140

Magnolia Metal Co. ..... *
Manhattan Rubber Div. ..... *
Marlow Pumps ..... *
Mason-Neilan Regulator Co. ..... *
McGraw & Co., F. H. ..... *
Mercoid Corp., The ..... *
Milton Roy Co. ..... *
Monsanto Chemical Co. ..... *

National Aluminate Corp. ..... *
National Boiler Protector Co. 132
National Conveyor Co., Inc. ..... *
National Electric Coil Co. ..... *
National Supply Co., The ..... *
New York & New Jersey Lubricant Co.. 142
Niagara Blower Co. 143
Nicholson & Co., W. H. 129

Orr & Sembower, Inc. 39
Owens-Illinois Glass Co., Kaylo Div. .. *

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ADVERTISERS' INDEX

Where an * appears after a name the advertisement does not appear in this issue, but appeared in previous issues.

Peabody Engineering Corp. ..... *
Peerless Pump Div., Food Machinery & Chemical Corp. .... *
Permutit Co. ..... *
Pick Manufacturing Co. ..... *
Petro-Chem Development Co., Inc. 141
Porter Co., Inc., H. K. ..... *
Powers Regulator Co., The 46
Prat-Daniel Corp. 101
Preferred Utilities Mfg. Corp. ..... *
Pritchard & Co., J. F. 132
Proto Tools 6
Prufcoat Laboratories, Inc. ..... *
Pyramid Instrument Corp. ..... *

Quaker Rubber Corp. 109

Ranney Method Water Supplies, Inc. .... *
Raybestos Manhattan, Inc., Manhattan Rubber Div. ..... *
Raybestos Manhattan, Inc., Packing Div. ..... *
Refinite Corp. 134
Reading Elevator Co., Inc. ..... *
Refractory & Insulation Corp. 148
Research Corp. 57
Riley Stoker Corp. ..... *
Rockwell Co., W. S. 149
Rockwell Manufacturing Co., Edwards Valves, Inc., Subsidiary .... *
Rust-Oleum Corp. 23

Sarco Co., Inc. 42
Schramm, Inc. 37
Silent Hoist & Crane Co. 145
Sinclair Refining Co. ..... *
Skinner Co., M. B. 138
Smooth-On Mfg. Co. 145
Spence Engineering Co., Inc. 103
Spencer Turbine Co., The ..... *
Standard Oil Co., (Indiana) 35, 36
Standard Stoker Co., Inc., The ..... *
Stephens-Adamson Mfg. Co. 66
Sterling Co. 131
Stewart-Warner Corp., Alemite Div. 27
Streeter-Amet Co. ..... *
Strong, Carlisle and Hammond Co. .... *
Sun Oil Co. ..... *
Superior Combustion Industries, Inc. ..116
Superior Electric Co., The 40, 41
Syntron Co. 127

Taylor and Co., W. A. ..... *
Terry Steam Turbine Co., The 150
Texas Co., The ..... Fourth Cover
Thermix Corp., The 58
Thermobloc Div., Prat-Daniel Corp. ..... *
Thomas & Associates, H. Emerson .... *
Todd Shipyards Corp., Combustion Equipment Div. ..... *
Trane Co., The 3
Trerice Co., H. O. ..... *
Trico Fuse Mfg. Co. 115
Troy Engine & Machine Co. 3

Union Carbide & Carbon Corp., Linde Air Products, A Div. 50
U. S. Hoffman Machinery Corp. ..... *

Viking Pump Co. 146
Vogt Machine Co., Henry 61

Waldron Corp., John ..... *
Warren Steam Pump Co., Inc. 64
Weinman Pump Mfg. Co., The 113
Weil Equipment Mfg. Corp. ..... *
Westinghouse Electric Corp., Sturtevant Div. ..... *
Weston Electrical Instrument Corp. 54
Wickes Boiler Co., The ..... *
Wiedeke Co., The Gustav ..... *
Wiegand Co., Edwin L. ..... *
Wiley & Sons, Inc., John ..... *
Wilson Inc., Thomas C. 20
Wing Mfg. Co., L. J. ..... *
Worthington Pump & Machinery Corp., Steam Turbine Div. 43
Worthington Pump & Machinery Corp., Multi-V Drive Sales Div. 47
Worthington Pump & Machinery Corp., Verticle Turbine Div. 31
Worthington Pump & Machinery Corp., Water Treating Div. 56
Worthington Pump & Machinery Corp., Pump & Compressor Div. ..... *
Worthington Pump & Machinery Corp., Engine Div. ..... *
Wright-Austin Co. ..... *

Yarnall-Waring Co. ..... Third Cover
Yarnall-Waring Co. 28, 29
York-Shipley 53

Zink Co., John ..... *

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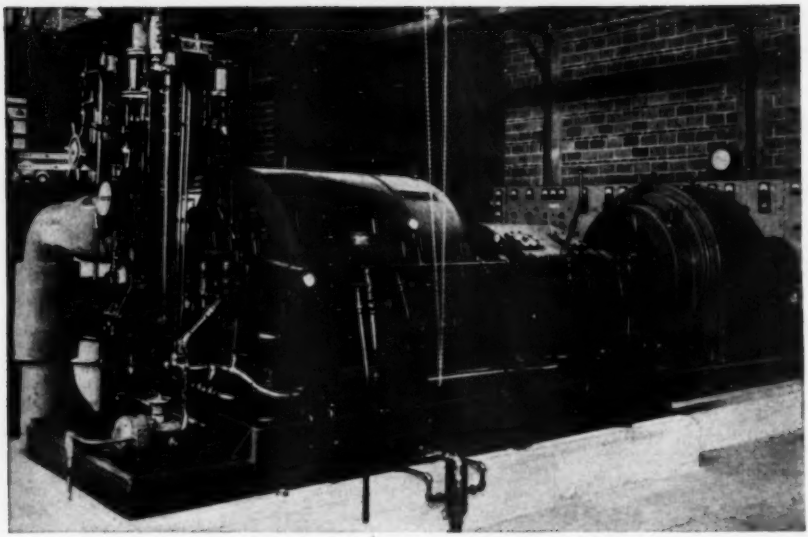

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TT 1187

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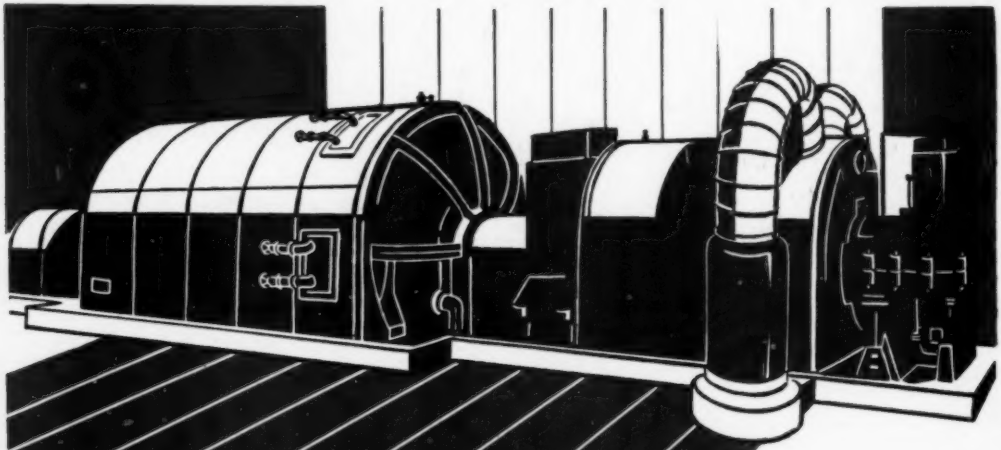

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